SCIENTIFIC AMERICAN

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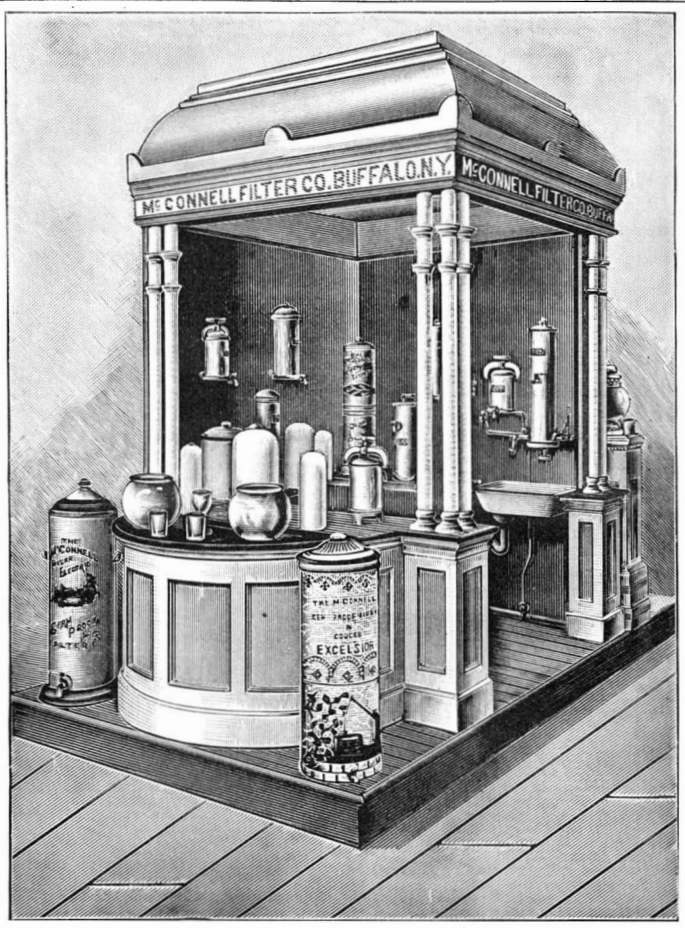
THE McCONNELL GERM-PROOF FILTERS.

Any exhibit designed to illustrate the facility with which water may be freed from possible disease germs, with tolerable certainty and at a moderate cost, was certain to command its full share of attention at the World's Columbian Exposition, where not a few of the visitors, at the beginning of the season, had most exaggerated fears of the quality of the water supplied. In the display of the McConnell Filter Co., of Buffalo, N. Y., are filters of simple construction designed to show a high degree of perfection in operation, adapted for attachment to the water pipe, and so made that it will be but little trouble to keep the filtering medium entirely clean and pure. There are also other styles, made as gravity filters, and as filter and cooler combined, the latter being so arranged that the melted ice does not contaminate the filtered water. The filtering material consists of a porous wall, made of a composition of the finest mineral flour, whose nature is not to paste or flint, but to remain sufficiently porous to allow only pure water and air to pass through it. The impurities are collected on the outer side, from which they are easily washed. These filters are made in all sizes, from those suitable for use in small families up to those of a capacity adapted for restaurant and hotel use.

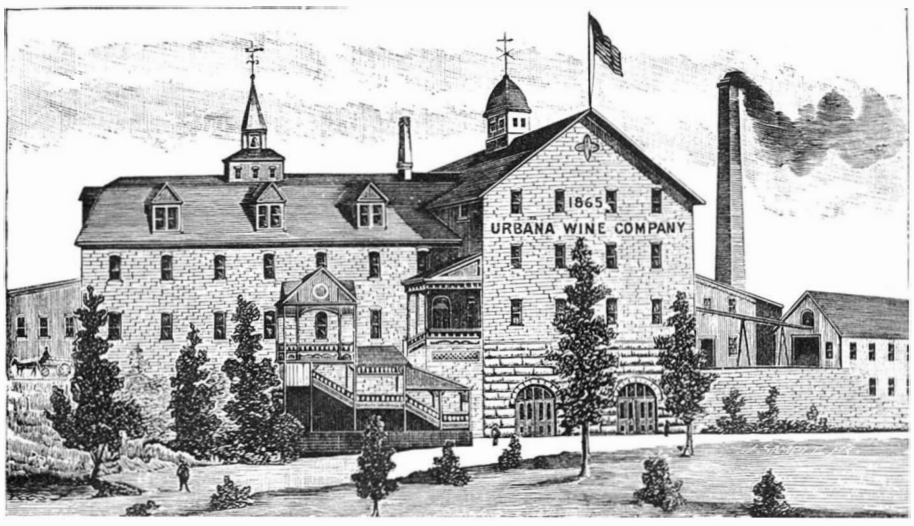


THE WORLD'S COLUMBIAN EXPOSITION—EXHIBIT OF McCONNELL FILTERS.

WINE MAKING REPRESENTED AT THE FAIR.

The very fine showing presented at the Columbian Exposition by American wine makers has not been surprising to those who are familiar with the growth of this branch of business as an American industry within a few years past, however it may have been to those who have heretofore supposed all our best wines were imported. The great variety and the number of high quality wines here exhibited, as well as the numerous large establishments represented, afford the best answer to such erroneous assumptions. Among the notable exhibits in this line is that of the Urbana Wine Company, of Urbana, N. Y., shown herewith, in connection with which we give also views of the "finishing room," and one of the champagne vaults at the works, as well as of the main buildings, as they were established in 1865, although they have since been greatly enlarged. It will thus be seen that in all wines which require "aging" to bring out their finer qualities this establishment has had the advantage of more than a quarter of a century's existence, during which period it has had a continuously large and prosperous business, its wines steadily growing in popularity in comparison with the most favorite brands of imported wines.

As the first requisite in the making of a superior wine is to have the best quality and fine varieties of rich, ripe grapes, it was the obvious advantages presented in these particulars that originally led to the location of the works on the shores of Lake Keuka, or Crooked Lake, Steuben County, New York State. Here, besides the vineyards owned by the company, is a large grape-producing country, which has been famous in this respect for many years. The soil is a gravel on calcareous rock, the ground is undulating and sometimes precipitous, but with a general southeast exposure toward the lake, and the location has been styled the Rheims of America. The principal varieties of grapes cultivated are the Catawba, Isabella, Delaware, Iona, Concord, and



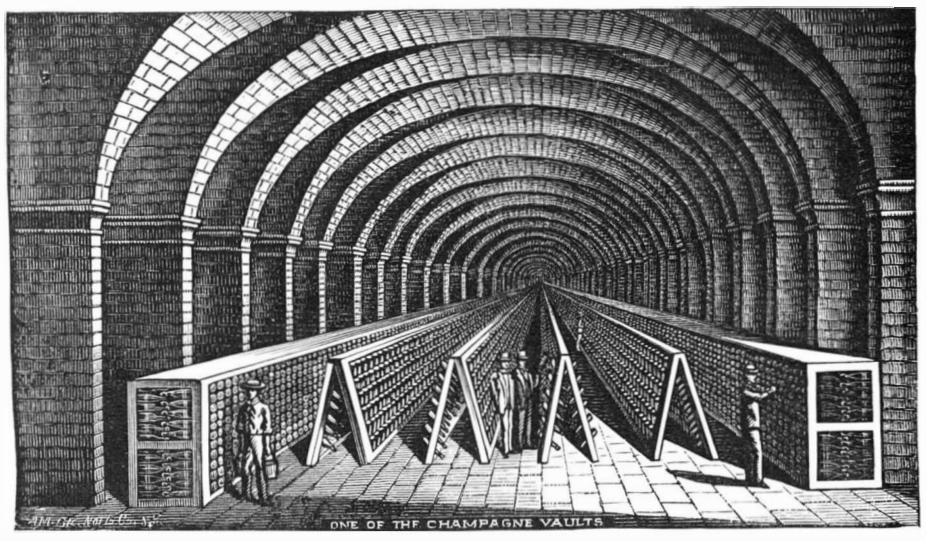
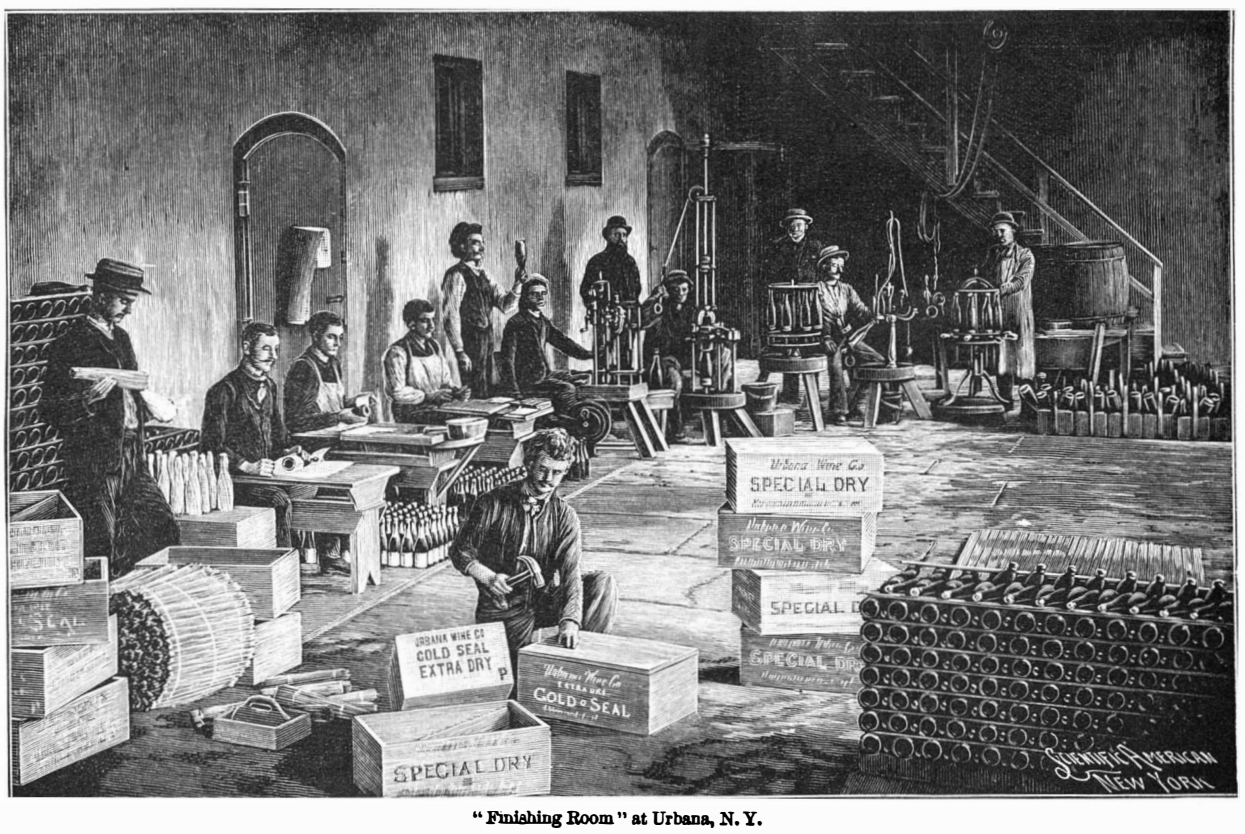


Exhibit at the Fair.



"Finishing Room" at Urbana, N. Y.

THE WORLD'S COLUMBIAN EXPOSITION—EXHIBIT OF THE URBANA WINE COMPANY, URBANA, N. Y.

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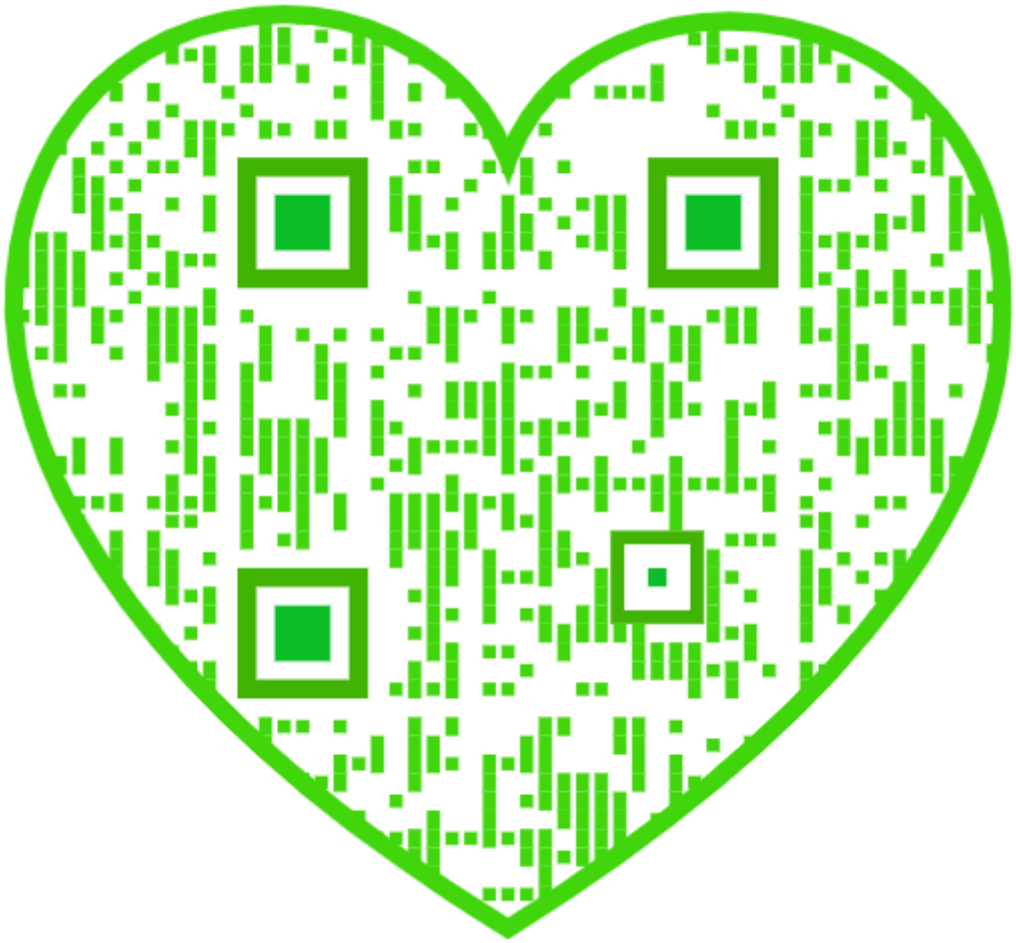

Elviras, and several others, and it is the proper selecting and combining of the fermented juices of these grapes, under carefully regulated conditions, that gives the high quality to the various still and sparkling wines made. The "Gold Seal" brand of champagne, prominently displayed in the company's exhibit, has been for many years a leading article of their production, and stands deservedly high in the wine trade and among connoisseurs throughout the country.

The still wines of this company are deserving of especial attention, all being made from the most careful selection of grapes, and they are vouched for as "pure," which makes them particularly desirable with those who want pure goods, and desire to avoid adulterations. All stock is well aged, and sold at a low price, considering the quality.

The Late Hayward A. Harvey.

Hayward A. Harvey, the inventor of the Harveyized steel armor plate process, passed away August 29, at his home in Orange, N. J. Mr. Harvey was born in Jamestown, N. Y., January 17, 1824. His father was General Harvey, the inventor of the gimlet-pointed screw, the cam motion, and the toggle joint. Young Harvey entered the office of the New York Screw Company as draughtsman in 1844, he took charge of a wire mill at Somerville, N. J., in 1850, and in 1852 he became connected with the Harvey Steel and Iron Company, of which his father was president. In 1865 Mr. Harvey founded the Continental Screw Company, of Jersey City. The inventions of Mr. Harvey, up to this time, had nearly all been in the direction of automatic machinery; but he afterward devoted his energies to metallurgical processes, and in 1888 he took out his first patent on a process for treating steel. This invention has now made his name familiar all over the civilized world, and has added another word to our language.

The new process is, briefly, a method of hardening steel on the surface, or carbonizing it, and raising steel of a low grade to a higher one. The first armor plate treated by the Harvey process was made in 1890. The Harvey Steel Company was organized in 1889, and works were established at Brill's Station, near Newark, on the Pennsylvania Railroad. Various improvements were introduced in the manufacture of armor plates, and to-day Harveyized steel armor plate stands without a rival. The tests made at the Indian Head Proving Grounds, a few weeks ago, proved conclusively that Harveyized steel plates are the best in the world. In a comparative test with English compound armor plate, Creusot all steel plate, and the regular United States nickel-steel plate, the Harveyized plate proved to be better than any of the others. The construction of battleships has been modified by the introduction of Harveyized armor, and the new process is being adopted by the principal manufacturers of Europe. Mr. Harvey, in the course of a long and eventful life, had 125 patents granted to him.

The Lantern in Scientific Stage Effects.

Some new scientific stage effects were introduced into a recent performance of Wagner's *Die Walkure*, at the Grand Opera House, Paris. The scene where the sons of Wotan, mounted on steeds and brandishing their lances, are seen in the clouds, is described as very realistic. The foreground is wild and rocky, and the clouds are seen to scud across the sky. This effect is produced by projecting the image of a cloudy sky by an electric lantern on a curtain of translucent blue cloth. The continuous movement of the clouds for half an hour is produced by painting them on the edge of the disk of glass twelve inches in diameter, and rotating the edge past the lens of the lantern. Three lanterns are employed to blend the clouds. The wild cavalcade of Wotan's heroes is produced by a line of mechanical horses, full sized, and carrying real performers. They are supported on a scaffolding, and drawn by means of a cable across the scene at a suitable elevation. The mounted men are strongly illuminated by the electric light, and thus rendered visible through the translucent curtain representing the heavens. The scene terminates by a conflagration, in which great flames run along the rocks, while thick fumes, reddened by Bengal fire, spread through the atmosphere. The flames are due to fulminating cotton, placed in advance on the rocks, and lit by the machinists. Lycopodium powder is also blown through holes in the stage. Weird cloud effects are produced by steam.

THE latest use for aluminum is for street car tickets, and it must be conceded that the metal is singularly adapted for the purpose. A Michigan street railway has just made its first issue of these light and ornamental tokens, which are about the size of a silver quarter dollar. One is round for the ordinary fare, the other octagonal for children. The adult's ticket is sold by the railroad company to the public at the rate of six for a quarter and the child's ticket at the rate of ten for a quarter. The company does not allow its employes, either conductors or motormen, to sell the tickets to the public, but disposes of them in $10 lots to the several storekeepers who handle them exclusively.

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Contents.

(Illustrated articles are marked with an asterisk.)

Air cooling by underground pipe 183
Aluminum tickets 178
Ang-Kor, ruins of 182
Animal vocabularies 188
Birds and animals, intelligence of 186
Brake valve, Pelham's* 180
Brazing (5356) 189
Cattle stall, Aeberly's* 181
Comet, the Rordame* 183
Contractors, a chance for 178
Diamond, a monster* 183
Diver, northern* 184
Egg hatchings 188
Electrical binding post, Kohl's* 181
Electric trolley wire finder, Jones'* 187
Exposition, Columbian—American wines shown at, by Urbana Wine Co.* 177
Exposition, Columbian—Awards at the 182
Exposition, Columbian—Cavern, marvelous, Black Hills, represented at 179
Exposition, Columbian — Drop forgings, exhibit of J. H. Williams & Co.* 180
Exposition, Columbian—Filters, the McConnell, at the* 177
Exposition, Columbian—Grand South Canal, view on the* 185
Exposition, Columbian—Horse powers, etc., of A. W. Gray's Sons* 187
Exposition, Columbian — Pens and ink, Caw's exhibit of* 181
Exposition, Columbian — Pens, Esterbrook, exhibit of* 181
Exposition, Columbian — Platinum exhibit, a costly 185
Exposition, Columbian — Vase, largest turned, at* 182
Exposition, Columbian—Wagons, heavy, of Chatham Mfg. Co.* 187
Exposition, Columbian—Notes 179
Fair, Midwinter, at San Francisco 180
Fire engine, a bicycle 180
Flowers, cut, how to preserve 188
Flowers, frozen, to ship 186
Guns, the new 13-inch 181
Gun, the Brown wire 187
Harvey, H. A 178
Inventions, recently patented 189
Lantern, the, in stage effects 178
Lemon sirup 183
Manufacturing in the U. S 187
Metric equivalents 185
Money of the world 182
Navy, French, increase of the 185
Notes and queries 189
Olympia, the new cruiser 179
Painting, seaside 183
Patents granted, weekly record 189
Plumbago as a lubricant 183
Printing press counter, Clayton's* 180
Pumps, well (5362) 189
Railroads, safety on 178
Sawing, a large day's 179
Sugar, Manila 187
Tempering mainsprings 188
Valiant, the Vanderbilt yacht 184
Watch, a cheap* 180

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 924.

For the Week Ending September 16, 1893.

Price 10 cents. For sale by all newsdealers.

PAGE

I. AGRICULTURE.—Note on the Sugar Beet Cultivation 14773
Polygonum Sachalinense.—A plant introduced into France from Russia, of great possibilities as a forage plant.—1 illustration 14770
Selection of Sorghum Seed.—How the United States Department of Agriculture selects sorghum seed at its Kansas station 14770
II. BOTANY.—Dragon's Blood.—Curious historical notes on this well known resin 14770
III. CHEMISTRY.—Attempt at a General Method of Chemical Synthesis.—By RAOUL PICTET.—Eight laws of chemical relation proposed as a base for a general method of chemical synthesis 14773
IV. CIVIL ENGINEERING.—Sinking a Siphon Trap.—A trap for condensed moisture, for use in steam heating systems.—2 illustrations 14761
The Ismuth of Corinth Canal.—Interesting ceremonies on the opening of the recently completed canal 14759
The Opening of the Corinth Canal.—Notes on the construction and engineering features of the great canal.—8 illustrations 14759
V. COLUMBIAN EXPOSITION.—Canada at the World's Columbian Exposition.—Interesting features of the exhibit of Canada in Chicago.—1 illustration 14766
German Notes from the Chicago Exposition.—How the Fourth of July was celebrated at Chicago.—By a German observer.—1 illustration 14766
VI. ENTOMOLOGY.—Soap as an Insecticide.—The advantages of whale oil soap and results obtained with it in destroying insects on California trees, with formulæ 14769
VII. ETHNOLOGY.—Among the Australian Aborigines.—Continuation of this interesting and graphic article on the Australian savage and his habits.—3 illustrations 14771
The Hottentots of South Africa.—By NICOLAS PIKE.—Graphic and popular description of the characteristic race of Ethiopia 14772
VIII. GEOLOGY.—Theories of the Origin of Mountain Ranges.—By Prof. JOSEPH LE CONTE.—The president's address before the American Association at its August, 1893 meeting 14768
IX. HYGIENE.—Music and Longevity.—By EPHRAIM CUTTER, M.D.—The good effects of music on the human system, with personal reminescences and examples 14764
On Poisoning from Canned Fish.—By Dr. A. B. GRIFFITHS.—Analysis of a new ptomaine, with other ptomaines and their formulæ 14765
X. MECHANICAL ENGINEERING.—Improved Steam Striker.—A powerful type of steam hammer, giving 500 blows a minute.—2 illustrations 14762
XI. MISCELLANEOUS.—The Great Populous Centers of the World.—By Gen. A. W. GREELY.—The 100 largest cities of the world, with their populations 14763
Scientific Terms.—The philology of scientific words and their derivations 14763
XII. NAVAL ENGINEERING.—The British Protected Cruiser Grafton.—Recent trial of a British ship of high speed 14762
XIII. PHYSICS.—Electrical and Light Vibrations.—The action of metallic gratings on electrical oscillations 14765
XIV. TECHNOLOGY.—An Improved Method of Purifying Toluol, Benzol, etc.—By R. J. FRISWELL.—An improvement in the manufacture of these coal-tar products 14774
Apparatus for the Concentration of Sulphuric Acid.—The use of hot gases in direct contact with the surface of the acid to facilitate its concentration.—3 illustrations 14773
Linseed Oil Varnish.—A simple and practical test for linseed oil 14762
The German Tar Distilling Industry.—Notes on this industry as practiced abroad 14762
The Sucking Up of Dangerous Liquids by Siphon.—An apparatus for decanting sulphuric acid and similar liquids in factories.—1 illustration 14763

A CHANCE FOR AMERICAN CONTRACTORS.

In another column will be found the advertisement of the Public Works Department of Cairo, Egypt, in which bids are called for relating to the construction of certain street railways in that city and vicinity. Here would seem to be an opportunity for some of our enterprising contractors.

The administration of the Egyptian government under the English advisory auspices has been attended with great success. The financial condition of the country is stable and reliable. In all departments of the government valuable reforms have been made, and nearly everything is now conducted on modern methods. The Public Works Department of Egypt is especially noteworthy for its successful efforts in introducing new improvements. Splendid engineering works relating to the Nile irrigation have been constructed at vast cost, whereby the productive area of highly fertile lands has been greatly extended. Railways have been introduced, telephone and telegraph lines made universal, postal facilities increased and improvements of all kinds along the lines of modern progress brought in. The present proposals for tramway lines doubtless will be found worth looking into.

SAFETY ON RAILROADS.

Within a very recent period several fatal railroad accidents have been chronicled which were of a nature as to point to one conclusion—the futility of trusting to direct human agency for protection. A railroad is assumed to be of the highest standard when equipped with a block system. But as usually interpreted, the block system is far from affording absolute protection. It displays a danger signal and perhaps also a caution signal when a train is within a certain distance of the signal station last passed by it. A following train on the same track is supposed to be arrested by these signals, and the train in advance is thus protected. The signals may be entirely visual. Semaphores by day and colored lanterns by night may be employed. A bell may also be used, which will ring as long as the block in advance is occupied, this constituting an aural signal, or one addressed to the ear. Torpedoes may also be used.

Such is the block system, by which all first-class railroads are guarded. In some cases it is applied by operatives stationed in watch towers along the line of the road. In other cases the manipulation is entirely automatic, electricity, pneumatic and hydraulic power being employed to work the signals. The locomotive itself effects the changes of signals as it leaves one block and enters another. In any case its operation consists in working a signal system for the guidance of the engineer of the locomotive. If it is the watch tower system which is employed, the vigilance of the signalmen as well as of the engineer is an absolutely necessary factor for its working. If the automatic system is employed, then the engineer is the only one who is depended on. There seems to be less chance of error in the latter case.

The block system is designed to prevent collisions. Its defect is at once apparent. It relies absolutely on human agency to prevent accident. Its functions end with the display of a warning signal. It has been proposed to add to it an apparatus which would strike a lever or valve handle on the engine, thereby throwing the brakes into action or shutting off steam if the engine passed a danger signal. This appliance has not been adopted to any extent. Even the best block and signal system has proved so ineffective that when a train stops unexpectedly from any cause, an apprehension of rear end collision may always be felt. This has gone so far that it seems as if the passengers for their own safety should be directed to leave the cars in such contingencies.

In 1853, on the New Haven road, a very bad accident, resulting in the loss of 46 lives, occurred at South Norwalk. A drawbridge was open and the danger signal, announcing this fact, was properly shown. Yet the engineer of an express train ran by the signal and the train plunged into the gap. It was a fearful illustration of the point we have been making—the inefficiency of the human element in signaling operations. The accident resulted in the passage of a law requiring every train to come to a full stop before crossing a drawbridge. This was certainly a confession of weakness. The law was next satisfied by the use of derailing switches at drawbridges. A derailing switch is one which, when opened, causes a train to leave the track and run along the surface until it stops. Such a switch connected with a drawbridge mechanism so as to be thrown into the derailing position when the bridge is open, will prevent the train from plunging through it. It eliminates completely the personal element and takes care of a danger point automatically. It represents the automatic stoppage of a train as contrasted with a simple danger signal designed to warn the engineer.

Throughout the whole system of railroad signaling runs the element of uncertainty. A train is brought to a stop between stations, owing to some accident. A signalman with a lantern by night or flag by day

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walks back to warn any approaching train. It is quite problematical how far back he may go. He may seek the shelter of a station *en route*, thinking all is safe. He may be but a few car lengths back when an approaching train appears, in a few seconds colliding with the other one. An engineer may follow up a long line of hundreds of block signals, and when weary with their endless recurrence, may pass the critical one. Signal tower operatives may fail in giving the proper signal.

It certainly seems as if there was room for invention in the elimination of the personal element from railroad signaling. It should be possible to devise some rational system by which a danger signal would absolutely stop a train, should the engine runner fail to do so. The electric current which is employed in the automatic block system might be made to do this, thus avoiding the clumsier mechanical methods.

If a train is unexpectedly forced to stop, some efficient system of warning another train approaching from the rear should be practicable. It has been proposed to provide a little car to run upon a single rail, which car is to be driven by a rocket attached to it. It would carry a torpedo. On the stoppage of a train for an accident it would be dispatched from the rear. In a few seconds it would be a thousand feet or more away. An approaching train would run over it and explode the torpedo, thus warning the engineer. But to-day the slow-moving brakeman is the usual agent. Before he would reach a point even a thousand feet distant, an express would run several miles.

One recent invention accepts the liability to collision, and constructs cars on a principle specially designed to withstand a shock, and not to telescope. Our inventors and engineers should go a step further, and make accidents all but impossible. To-day a rear-end collision should be an impossibility. But sad experience, involving many deaths and injuries, continually shows that it is a constantly menacing danger. The double-track road with fast and heavy traffic is now as dangerous as was the old-time single track with its limited number of slow trains.

The Olympia.

The Olympia, one of the finest protected cruisers ever constructed, is rapidly approaching completion at the Union Iron Works, San Francisco. The Olympia is the largest unarmored cruiser built for the navy, except the Columbia and the Minneapolis. She has a displacement of about 5,600 tons and a coal capacity of 1,300 tons, which gives her a radius, at 10 knots, of 13,000 miles. The guaranteed speed of the Olympia is 20 knots. She has already sustained a sea speed of 19 knots, which is far ahead of what is generally found in vessels of her class. The Olympia is 340 feet long, beam 53 feet, and 21½ feet draught. She has three complete decks and a large superstructure amidships. The vessel is provided with two masts with fighting tops and an electric light on each. She has a complete protective deck of 4¾ inches of steel on forward slope and 2 inches on the flat throughout. All around the ship is a belt of water-excluding substance. Coal is so stowed that the machinery will be protected as much as possible. The machinery consists of twin screw, vertical inverted, direct-acting, triple expansion, three cylinder engines, in two watertight compartments. The cylinder diameters are 42, 59, and 92 inches respectively, with a 42 inch stroke. The air and circulating pump engines are driven independently. The total horse power of the propelling and pump engines is expected to be 13,500 at 129 revolutions per minute of the screw engines.

The main battery consists of four 8 inch and ten rapid-fire 5 inch guns, as well as a secondary battery of fourteen 6 pounder rapid-fire guns, six 1 pounders, and four Gatlings. There is a fixed torpedo tube in bow and stern, as well as two training tubes in each side. The Olympia is a fine vessel of the commerce destroyer type, and her high sea speed and her prolonged radius of action make her a valuable ship for use in the Pacific Ocean.

A Large Day's Sawing.

At the sawmill of M. T. Jones & Co., of Lake Charles, La., recently, 191,323 feet of lumber were cut in eleven hours. This is said to be the largest amount of lumber ever turned out of a single circular sawmill in that number of hours. The saw was driven by a Corliss engine, having a cylinder 22 inches in diameter by a 40 inch stroke, the drive wheel being 20 feet in diameter with a 30 inch face, the engine making 65 revolutions per minute, with an average steam pressure of 100 pounds. The mill was provided with a steam log turner and a twin feed engine, 14 × 24, and steam log trippers. The saw mandrel was 4 inches in diameter, with water-cooled journal boxes. The saw was 54 inches in diameter, No. 6 gauge, with 80 teeth. The steam was generated by sawdust taken direct from the saw.

The credit of this feat is largely due to Mr. W. N. Elliott, saw filer, and Mr. Ed. Bullock, sawyer.

We are indebted for these facts to Mr. W. S. Whitman, chief engineer of the mill.

THE MARVELOUS CAVERN OF THE BLACK HILLS.

BY H. C. HOVEY.

The glazed dome of the Horticultural building is one of the most imposing of the numerous elegant structures to be seen at the World's Fair. It is 180 feet in diameter and 144 feet high and is approached through pavilions, halls and galleries adorned by countless exotics. Directly under this huge dome arises a miniature mountain that artistically conceals the heating apparatus. Along its flanks and crest grow the largest palms, tree ferns, bananas and bamboos that will bear transplanting. Amid this tropical greenery bloom hundreds of gay flowers and twine a myriad clinging vines.

Underneath this floral wealth extends a marvelous reproduction of one of our most recently discovered and brilliantly decorated American caverns. Perhaps without sufficient reflection the owners have styled it "The Mammoth Crystal Cave," which really trenches on the name for generations appropriated to the great cavern of Kentucky. But as no map or guide book has yet been published, and all the names of the new cave may be regarded as tentative, the ingenuity may wisely be taxed for wholly novel and suitable names. Even "Columbus Cavern," or "Colossal Cavern," would be an improvement on the present plagiaristic title, which for want of any other will have to be used in this article.

The idea of rock work under the dome originated with the directors, but the cave proprietors hit on the bold and original conception of substituting for mere rock work a reproduction of their subterranean marvel. These gentlemen, Messrs. Keith and Allabough, who are also on the grounds to look after their interests, assured me that they began preparation two years ago by setting some seventy men at work in unfrequented parts of the cavern, collecting materials in such a manner as should not mar or rob the cave of its embellishments. The conditions forbade blasting. The crystals had to be patiently cut from the rock by pick and chisel. Thus 300,000 pounds were obtained of stalactites, stalagmites, onyx, geodic crystals, dog-tooth spar and sparkling botryoidal masses; of cave pearls, flos ferri, aragonite and dripstone stained by oxidation in as many colors as the rainbow. Having gathered these materials, it was a question what to do with them. At first the directors of the Fair were inclined to regard the exhibit as a show and to relegate it to the Midway Plaisance. But this was firmly withstood by the proprietors, who finally, after a delay of five months, obtained, through the intervention of parties interested in growing plant life by electric light, the concession of the present admirable location.

When the grotto was first opened, admission was free and continued to be so for a month. But such crowds flocked to see it as to make it actually necessary to restrain them by fixing the nominal fee of five cents for admission; and even this small sum is refunded in case the visitor buys specimens. Although the exhibit was not intended to be remunerative, the fees and purchases made by a million visitors have already reimbursed the proprietors for their original outlay of nearly $50,000 and met running expenses. As many as 20,000 persons explore the grotto daily, and the general expression is that of wonder and delight.

The grotto as constructed is in no sense a model of the original cavern, except as displaying specimens of its contents and some of the conditions under which they are found. It includes seven rooms with arched approaches and tasteful alcoves and ample space, every square foot of which is embellished by the brilliant crystal masses already described, varying in size from mere marbles to blocks weighing 600 pounds. This unique assemblage was the result of repeated experiments, as no skilled labor in the line of cave making was to be had. Lighted as it constantly is by a profusion of electric lamps, the place is certainly an attractive and instructive feature of the Fair.

The Mammoth Crystal Cave itself was discovered in South Dakota many years ago by miners for the precious metals. But it has never till recently been entered for more than 1,700 feet. In 1889 explorers began to break into new chambers, one after another, the process going on gradually, until now 1,490 halls and rooms have been opened. Some of them are low and muddy, while others are spacious and dry. The largest room of all is estimated to be 600 feet long, 300 feet wide and 100 feet high. The walls and floors of all the rooms and passageways are composed of crystals. What digging and blasting has been done only serves to bring more of this crystalline mass to view, or to break through into new apartments, or to open pockets like huge geodes.

The actual extent of the great cavern is unknown. Mr. Allabough assured me that about one-third of it had been accurately surveyed by chain, compass and level with reference to its being possibly lighted by electricity before long. This work was done by Mr. George S. Hopkins, United States mining engineer, of Deadwood, by whom a map was also prepared, which for prudential reasons has not been published, although I had the privilege of inspecting it. The total length of measured passageways approximates twenty miles. This seems to justify the statement that the whole caveway, as far as explored, is from forty to fifty miles long. There are eight different levels, or galleries, in the cave. The upper ones are extremely dry, the lower ones damp, and the lowest of all are so very wet at all seasons as to be styled "the rainy rooms." The owners are satisfied, however, that drainage level has not yet been reached. There are numerous pools, and three running streams, one of which has a waterfall sixty feet high—not a plunging fall, but a cascade flowing down a steep incline of travertine.

The formation in which this remarkable excavation is made is the corniferous limestone, judging from the fossils displayed. It is supposed to owe its origin to a small stream named Elk Creek, which sinks at a point seven miles above, and emerges again about four miles below, thus having eleven miles of subterranean flow. This theory gets confirmation from the fact that, in digging for the railroad along the banks of Elk Creek, crystal masses and pockets of dog-tooth spar were found like that to be seen in the cavern. Some of the specimens taken out were very fine, individual crystals of dog-tooth spar exceeding eight inches in length and of remarkable purity of material. The station of the Chicago and Northwestern Railroad being vertically 413 feet below the cave entrance, the theory given above would indicate a corresponding depth of the cave. And this is not incredible, for at places the hills are known to rise as much as 1,800 feet above the galleries already explored.

The surrounding region is densely wooded and highly picturesque. No interior vegetation of any kind has yet been noticed, nor any true cave fauna; nor have any Indian relics been found. Heaps of minute bones abound here and there, seemingly the remains of rats, mice, bats and other intruders from without. The temperature is cool, being said to be as low as 45° Fahr., which is hardly credible, as that would be 10° lower than the ascertained temperature of other great American caverns.

By whatever name this new and splendid cavern is to be known, it certainly combines the grandeur of the Mammoth Cave with the loveliness of Luray, besides having peculiar features of its own. It is worthy to be counted among the wonders of the world.

The total number of paid admissions for August was 3,515,493, and total number to date 10,000,906.

The Fair is wonderful to the wisest, and when you see the farmer just come out of the woods, with his large lunch box, strapped up with a piece of a harness, examining a string of sleigh bells or a patent cow bell, you might hear him remark: "What the thunder is that thing for?" for he was positive he knew something about cow bells. He cares nothing about style; he left his paper collar at home, and brought his long whiskers. He also wears the squeaky boots and carries the seven days' layers of dust on the uppers. Next you might see him standing in front of the Electrical Welding exhibit; then if you could see the astonished expression, as he knows he sees a man dip a cold piece of iron in a pail of water and it immediately turns red hot, while under water. It is comical to watch him; even his whiskers seem to absorb wonder, as you hear him say "Gosh!"

The Russian Government Pedagogic Museum displays scientific and other educational apparatus, together with cases of stuffed birds and animals; pictures of Russian life and specimens of mineral resources. The St. Petersburg School of Design contributes many fine specimens of lace and needle work done by girls, also samples of work done by boys in the Manual Training division. The Russian government displays in adjoining booths many sketches and diagrams of public engineering works. In the Imperial Post booth the various methods of carrying the mails is picturesquely shown. There is a model representing five men carrying the mails over the mountains through the snow in the Caucasus, where the footing has to be chopped out of the ice step by step. Another model represents three horses abreast in the usual Russian style attached to a two-wheeled mail cart. Near this three horses attached to a sleigh show this same route in winter. There is also a model of a mail cart drawn by two yokes of oxen; a special mail boat used in the Archangel district, rowed by women; a camel that carries the mail on his back in the deserts of the southeast; a mail sled drawn by reindeer as in

(*Continued on page 182.*)

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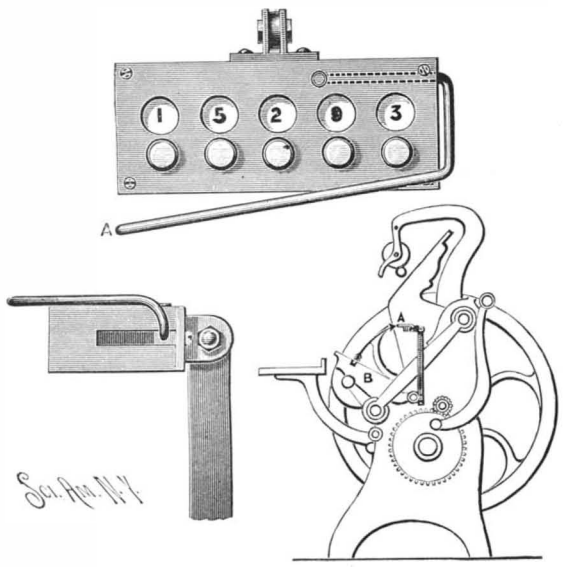
A COUNTING ATTACHMENT FOR PRINTING PRESSES.

This improved counter, which is adapted to automatically register each impression of the press, may be attached in such a way as to be easily thrown into operative position and easily tilted back out of the



CLAYTON'S PRINTING PRESS REGISTER.

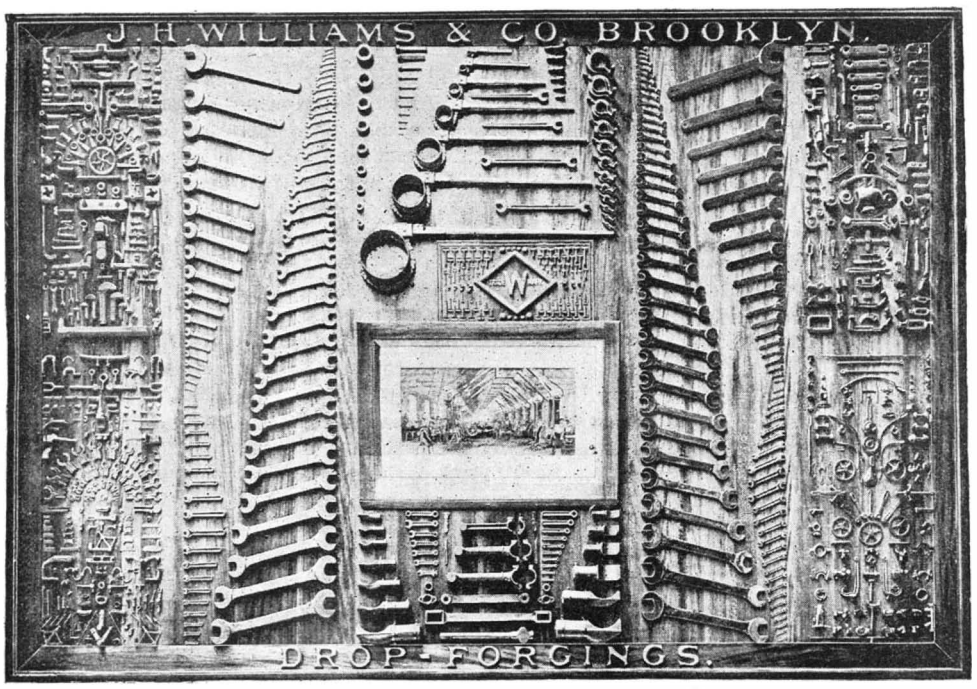
way, operating only when the press is actually printing, and not registering when the "throw-off" is used. The improvement has been patented by Mr. Herbert D. Clayton, of the *Hill City Reveille*, Hill City, Kansas. The counter is of the usual kind, with registering wheels and knobs for setting them, and it is operated by a lever which hangs down at a slight inclination to the bottom of the case, the lever being bent upward and laterally at one end, and finally entering a slot in the case, where its inner end is pivoted. A front view of the counter with its attachments is shown in the figure at the top of the picture, a side view being shown in the figure at the left, and the position of its attachment to the press on the right. On the top or back of the case containing the counting mechanism is a plate with projecting lugs pivoted to the upper end of a standard secured to one side of the frame of the press, the standard extending upward to a point near the path of the platen, so that when the case is swung into position for registering, its lever, A, will extend into the path of a finger or pin on the platen, B, of the press. If the counter is not to be used, it may be readily tipped over to the back side of the standard, out of the path of the finger. When the throw-off is used, the platen does not quite touch the type, and the finger and lever are so adjusted as not to come into engagement with each other except when an impression is actually made, or when the throw-off handle moves at the side of the platen the finger may be attached to the handle. The device is very simple, compact and inexpensive, can be readily attached to any job press, and the figures are always in plain sight of the pressman, who can at any time tell at a glance just how many sheets have been printed.

A Bicycle Fire Engine.

Experiments with a bicycle fitted out with a small chemical tank and fire ax are being made by a South Boston fire company. The bicycle has cushion tires and, with its whole outfit, weighs about sixty pounds. The tank holds about two gallons of chemical, which amounts as an extinguisher to about twelve pails of water.

DROP FORGINGS AT THE FAIR.

Aside from the general commercial interest which attaches to an international exhibit, the displays that are distinctive by virtue of their arrangement and class leave enduring impressions. A large wall space in Section C, of Boiler House extension, Machinery Hall, has made for J. H. Williams & Co., Brooklyn, N. Y., an exceptional place for the display of drop forgings. Looking from the main floor through the arched ways leading to the extension, this exhibit, mounted on a highly polished selected sycamore board, 16 × 22 feet, immediately arrests the attention of sightseers and invites a closer inspection. In a central position is a splendidly executed water color illustrating the interior of one of the best and most completely equipped forges in the country. Here, too, in this painting, is partially accomplished the illustration of methods scarcely known to the uninitiated. Drop forging has become the commercial definition of this art; but if we said "blacksmithing by machinery," it would be a literal description of the product, and greatly aid an interested public in comprehending the advanced methods in this line of manufacture. In addition to the illustration of a forge equipment, J. H. Williams & Co. have not, as far as it seemed practicable, overlooked the means necessary to further develop interest in an industry so important and still so young. To this end, and in addition to the wall exhibit, will be found dies, showing the impress of different articles and the forgings themselves in various stages of finish. A little study of the special forgings in any of the four artistically arranged panels devoted to this department of their wares suggests at once how it has been possible to manufacture the peerless and up-to-date American bicycle. Very much of the enviable reputation of this country for its unequaled sewing machines, guns and general small firearms, and, indeed, of all first-class machinery, is largely attributable to uniformly excellent drop forgings of a class supplied by this firm. The display of Brock's chain wrenches, engineers' wrenches, lathe dogs, collars, machine handles, etc., their staple articles of manufacture, well illustrates the rapid advances made in this age of improved tools and machinery. The engineers of the Edw. P. Allis, Frazer & Chalmers and Russell & Co.'s engines are showing with especial pride smaller boards equipped with this company's engineers' wrenches.



THE WORLD'S COLUMBIAN EXPOSITION—DROP FORGINGS EXHIBIT OF J. H. WILLIAMS & CO. BROOKLYN, N. Y.

A WONDERFULLY CHEAP WATCH.

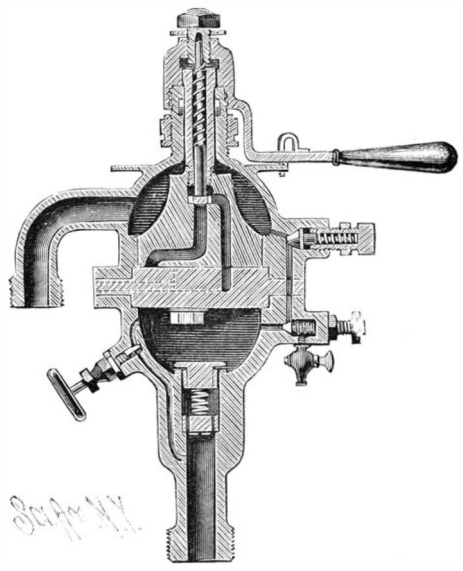
An American lever movement watch which will ordinarily keep good time, and which is sold at retail for $1.75, is shown in the picture. It has a "Columbus case" of special merit in point of design and workmanship, finished to represent either plain or oxidized silver or gold. The chains to go with this watch are made of a series of embossed medallions representing the heads of Columbus, Washington, Lincoln, Grant and Sherman. These "Columbus souvenirs" are made by Messrs. R. H. Ingersoll & Bro., No. 65 Cortlandt Street, New York City.

The Midwinter Fair.

Ground was broken August 24 in Golden Gate Park, San Francisco, for the California Midwinter International Exposition in the presence of 50,000 persons. It is determined to make this fair a success in spite of the present financial troubles. Propagandists have already secured numbers of exhibits from foreign countries, and some of the buildings will, doubtless, be ready to receive exhibits by the time the Chicago Fair closes.

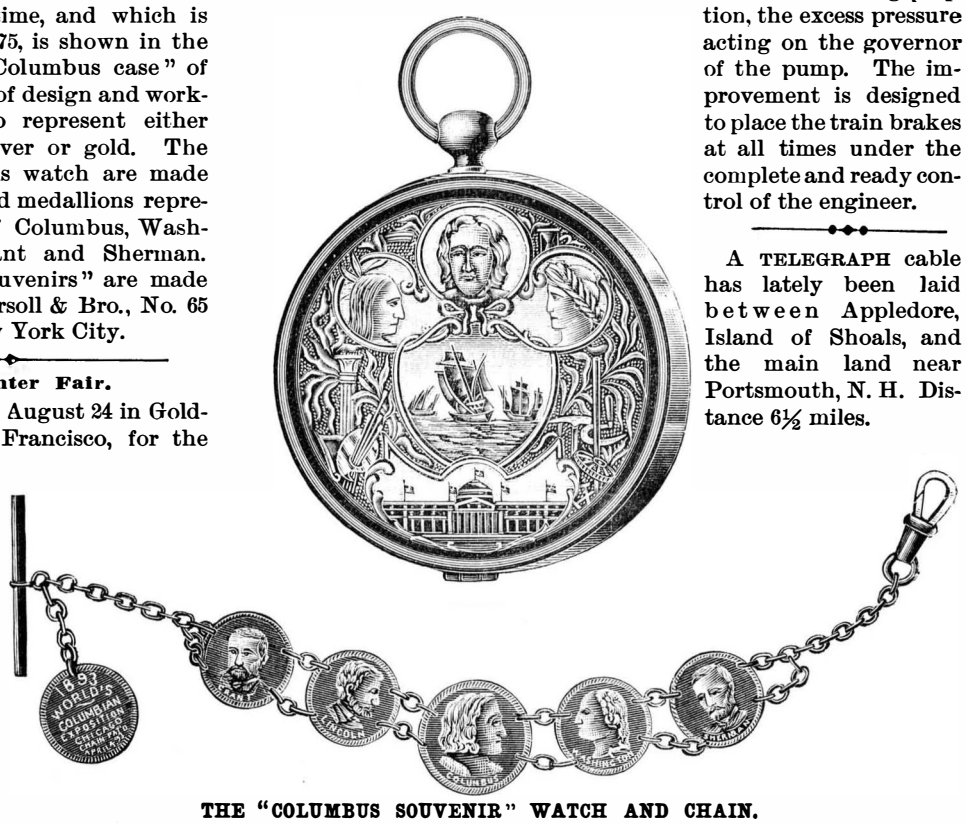
AN IMPROVED BRAKE VALVE.

The valve shown in section in the illustration is so made that it is not likely to clog or get out of order, and its construction is such that successive regular reductions may be easily made in the pressure of air in the train service pipe, it being adapted to automatically act on the governor of the air pipe from pressure either above or below the main valve. The improvement has been patented by Mr. Walter O. Pelham, of No. 313 West Munson Street, Denison, Texas. An elongated two-part casing forms upper and lower chambers of the valve, the parts having flanges held together by bolts, and the upper part of the casing having an inlet connecting with the main reservoir, while the lower part has an outlet pipe to be coupled to the train service pipe. A central stationary flat seat on



PELHAM'S ENGINEER'S GRADUATING VALVE.

which the main valve turns has a service port and an outlet port leading to the outer air, a face port in the valve registering with the service port, while a port leads from the face port to a chamber in the valve, the latter port being normally closed by a spring-pressed pop valve. A discharge port opening from the side of the chamber registers with the outlet port of the valve seat. An upwardly extending hollow stem secured to the valve is connected with a cap screwed to the casing, the cap being provided with a handle and turning with the main valve stem, and serving also as an abutment for the spring of the pop valve. The handle has a spring catch adapted to engage notches of a graduating plate marked off in the usual manner, as "full release," "running position," "laps," "service," and "emergency;" but between the lap and the emergency mark is a succession of five-pound marks, enabling a positive and accurate reduction of five pounds to be made in the pressure of the train pipe at each movement of the handle or lever from one notch to another. A connection with the governor is made through valve-controlled ports of both the upper and lower chambers in the main casing, giving an automatic double control, the excess of pressure in either part of the casing causing the governor to be acted upon. If the train parts, the pressure in the main reservoir will not be reduced, and excessive pressure is generated when the brake handle is in running position, the excess pressure acting on the governor of the pump. The improvement is designed to place the train brakes at all times under the complete and ready control of the engineer.



THE "COLUMBUS SOUVENIR" WATCH AND CHAIN.

A TELEGRAPH cable has lately been laid between Appledore, Island of Shoals, and the main land near Portsmouth, N. H. Distance 6½ miles.

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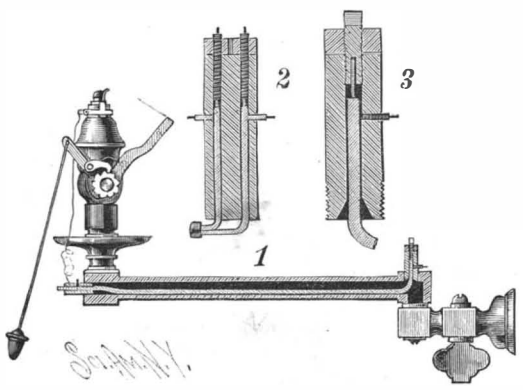
AN ELECTRICAL BINDING POST.

An improved binding post for insertion in gas fixtures, for making connections between the house wires and the burner wires, is shown in the engraving, and has been patented by Mr. Arnold Kohl, of Centralia, Ill. Fig. 1 shows the improvement applied to an electrical gas lighter, Figs. 2 and 3 being transverse sections of double and single binding posts, the former being used where the return current is conveyed by a wire instead of the fixture itself. The body of the post is of hard rubber or other insulating material, bored axially to receive the wires, the end to be inserted in the gas fixture having an external thread, while the other end has an internal thread to receive the contact screw. The latter is threaded, and upon it is placed a metallic nut, between which and the binding post body the house wire is clamped, the wire leading to the electrical gas lighter being similarly



KOHL'S BINDING POST FOR ELECTRICAL CONNECTIONS.

clamped by the nut of the binding post adjoining the burner. In the side of the post is a binding screw, for clamping the wire, and the inner end of the contact screw has an axial bore in which is received the exposed end of the wire in the fixed end of the fixture. Two such binding posts are necessary for completing the circuit through a gas fixture.

A STEEL PEN EXHIBIT AT THE FAIR.

One can readily believe that even so small an article as an ordinary steel pen may be the basis of an industry of considerable importance on looking over the fine exhibit of the Esterbrook Steel Pen Company at the World's Columbian Exposition. The business was established in 1860, and the works of the company are at Camden, N. J., where over one hundred and fifty different styles of the Esterbrook pens are made, the pens finding a market in all parts of the world. The house is the oldest and largest manufacturer in the United States, and makes pens for every purpose, and to suit all writers. It is a business that cannot be successfully conducted in a small way, the process of manufacture being intricate and complicated, each pen being subjected to a high degree of heat four or five times, and going through from thirty to forty hands before it is completed. The quality of the Esterbrook pens is concededly of the highest class; hence their universal popularity. It is one of the wonders of our modern progress in

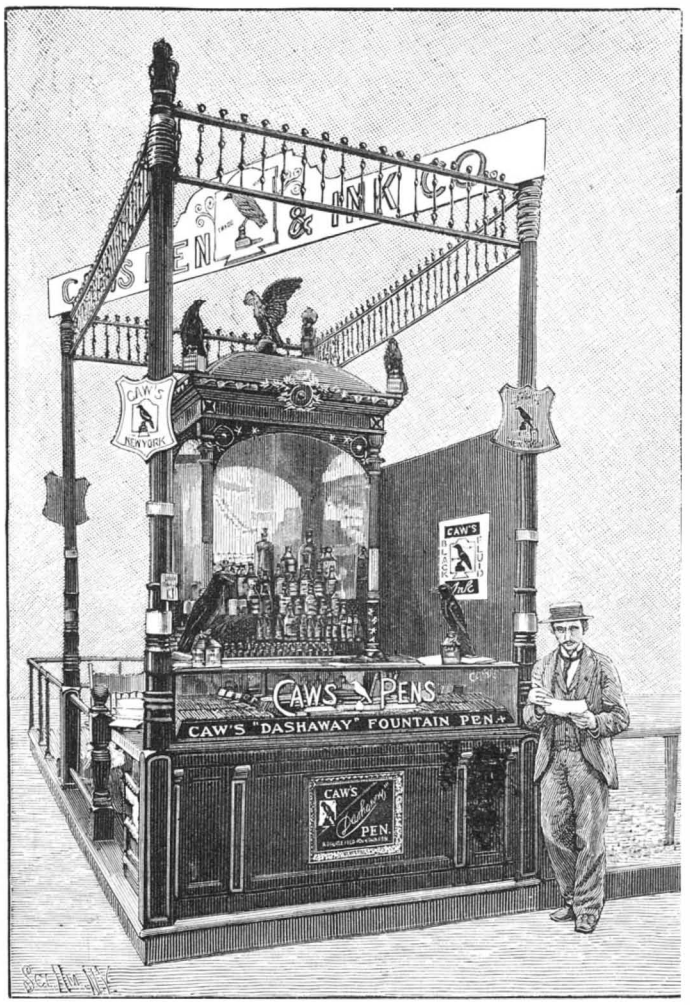
THE WORLD'S COLUMBIAN EXPOSITION—THE ESTERBROOK STEEL PEN EXHIBIT.

manufactures that the cost of making these now indispensable articles has been reduced to so small a figure.

The coast survey of the United States was begun in 1817.

THE CAW'S PEN AND INK COMPANY EXHIBIT.

Among the exhibits in the great Manufactures and Liberal Arts building at the Fair, one very beautifully arranged showcase is devoted to the display of the well-known Caw's pens and inks. These articles have become so popular from their large use by all who have any writing to do in every department of business and in all walks of life, as well as from the numberless unstinted indorsements of men prominent in the leading professions, that any detailed description would be superfluous. Fountain pens, for many years used almost exclusively by reporters and traveling men, have within a comparatively short period become almost indispensable to the business man and to those whose avocations are of a literary character in any way. This is because these pens have of late been made so simple, clean, and thoroughly effective that one can now, with the least care, depend upon always having and conveniently carrying upon the person a pen in good working condition, without danger of soiling the clothes or fingers therewith, the ink carried in the holder, and readily replenished, being sufficient to do a large amount of work. In consequence, also, of this largely increased use, and of the improvements introduced in the manufacture, the prices of this class of pens have been very greatly reduced. In Caw's "Dashaway" fountain pen, a regular first quality gold pen of any standard shape or size may be used. In this respect it differs from all other fountain pens. Another difference is in its "double feed," one on each side of the gold pen, which insures a more uniform and reliable delivery of ink than can be obtained from a single feed. President Cleveland uses one of these pens, and has furnished the company with a handsome testimonial. In Caw's stylographic pens the inventor seems to have obtained the acme of perfection and simplicity. The writing is done with a circular point similar to a pencil, but being tipped with an alloy of iridium and platinum, making it almost as hard as diamond, it will last many years. The stylographic pen carries ink in the holder the same as the fountain pen, and by many it is preferred to the ordinary split pen. With both of these pens any good writing or copying ink may be used, but the ink manufactured by the Caw's Pen and Ink Company has as high reputation as the pens, and has had a very large sale in the stationery trade for many years. It is a good black when first used, and in its manufacture an especial point is made to produce an ink which will not fade or mould, and will not gum or corrode the pen. The company displays its medals from the New Orleans Exposition of 1884 and the Paris Exposition of 1889, and expect to be equally successful in competition in Chicago.



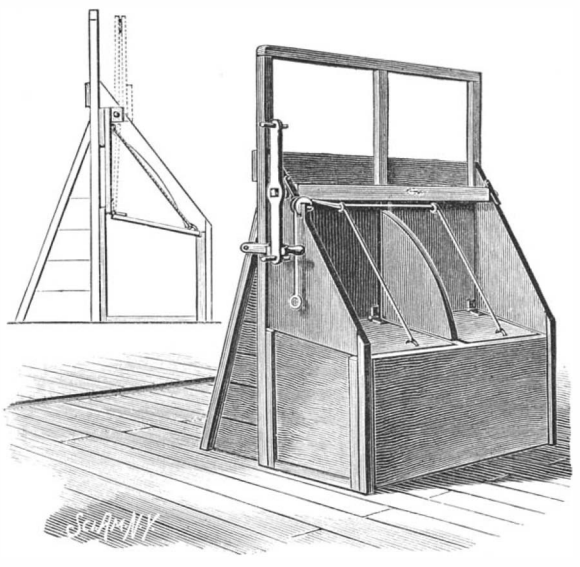
THE WORLD'S COLUMBIAN EXPOSITION—CAW'S PENS AND INKS.

The New 13 Inch Guns.

Twelve of the new 13 inch guns are needed for vessels now under construction. Four will be furnished to each of the following vessels, Indiana, Massachusetts and Oregon. It is now decided by the British Admiralty that guns of smaller caliber are better than the huge 110 ton guns, which are liable to many mishaps in firing and are entirely dependent upon machinery which might be disabled at a critical moment. The disaster of the Victoria, in which the guns played an important part, strengthens this opinion. The 13 inch gun is nearly 40 feet long and has a diameter of 4 feet at the breech and 21 inches at the muzzle. It is constructed on the built-up principle, in which a central steel tube has bands or jackets shrunk on. The projectile will be fired with 550 pounds of powder and will weigh 1,100 pounds. As soon as the projectiles can be constructed and the guns mounted a series of tests will be made with Harveyized armor plates as targets. The Brown segmental gun has shown a remarkable ability to stand heavy charges producing a high velocity and to resist great pressures.

AN IMPROVED STALL FOR MILK CATTLE.

The stall shown in the illustration is designed to enhance the comfort and conduce to the regular feeding of the animal. The improvement has been patented by Mr. Jakob Aeberly, of St. Paul, Minn. The stalls are preferably built in pairs, and have a transverse gutter at the rear of the stall flooring. The feed cribs are of such height as to readily permit the cattle haltered thereto to feed over their top edges, and at each wall of a crib are vertical stanchions, from the base of which a short vertical partition wall is extended rearwardly. The crib covers are hinged on pendent gates, whereby the cribs are not only closed at their tops, but the space above each crib is shut off from the stall. The



AEBERLY'S CATTLE STALL.

gates, to the lower edge of each of which is hinged a crib cover, are secured upon a rotatable transverse shaft, on the outer end of which is a transverse handle bar. A cord extending upward from the outer edge of each crib cover connects with a transverse cord passing over a grooved pulley at the side, the covers being raised and folded against the gates by pulling upon the cord, when both the covers and the gates may be raised, as indicated in dotted lines in the outline figure, by rotating the handle bar, thus affording a clear opening from each stall into the crib opposite it. A latch piece is adapted to be swung across the path of the handle bar to hold the gate locked in elevated position.

Further information relative to this improvement may be obtained of the patentee or of Mrs. M. Schembri, No. 396 Van Buren Street, St. Paul, Minn.

Sir Benjamin Ward Richardson, M.D.

The honors of knighthood have been conferred upon Dr. Benjamin Ward Richardson, of London, in recognition of his valuable discoveries in medicine and his great abilities as an instructor and writer.

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Notes from the World's Columbian Exposition.

(*Continued from page 179.*)

the extreme north; and a mail sled drawn by a dog team, as in Siberia. The rest of this exhibit comprises a full set of government postage stamps and post office supplies.

Several special days have been observed recently, but none have been more full of novelty or more picturesque than was the celebration by the Turks. A large number of representatives of this nation were present, and the procession from the Turkish village in the Midway Plaisance to the Ottoman building in the Exposition grounds was gorgeous and unique. It was made up largely of Bedouins mounted on spirited horses bedecked in their brightest garments and carrying their long, villainous-looking weapons. There was also quite an escort mounted on camels and donkeys. Nearly every man in the procession wore a fez, and many officials were dressed in the bright-colored insignia of their offices. The day was the seventeenth anniversary of the accession of the present sultan to the throne.

In the Mines building the "Statue of Salt" commands a wondering throng. It is said not a few elderly ladies go away believing that they have actually seen a replica of Lot's wife.

The model of the United States Treasury in the Administration building is another object of unfading attraction. It is built of Columbian half dollars, and considerable ingenuity has been displayed in its construction. The coins for the model were minted under an act of Congress, August 5, 1892.

The model of a prairie farm commands admiration. It was designed and partly executed by an Illinois girl, seventeen years of age. The principal materials entering into its construction are grain and grasses, and these have been handled with no small deftness and effect.

In the Anthropological building are some of the most important prehistoric relics from Carson, Nevada, from a quarry in the north end of a low sandstone ridge, a short spur of the Pine Nut Mountains. They consist of casts and in most cases the originals of footprints discovered in 1882. There are mammoth tracks, human tracks, horse tracks, and bird tracks. The quarry excavation is about 4,950 feet above the sea level. The formation is thus described: First, sandstone, forming the walls of the quarry and from 22 to 32 feet in height; second, the strata containing the prints; and third, the bed rock. There were also found mammoth teeth in good condition, and portions of the tooth and two jaw bones of a horse. The deposit where these remains were discovered is supposed to be Quaternary or Upper Pliocene, for in the opinion of Dr. Joseph Le Conte there are no indications of "the tall horse or elephant in the American Miocene."

The great liberty and peace bell for the Columbian Exposition, weighing 13,000 pounds, cast at Troy, N. Y., lately reached the Exposition.

It is one of the largest bells ever cast in this country, is seven feet in height, seven feet four inches in diameter at the mouth, and the tongue and bolt weigh 700 pounds. Every ounce of the metal of which the bell is made has a historic value as having been connected with the deeds of the Revolution and of other great struggles in the field of war in which the honor of the country was at stake. There are in it, among other things, bullets taken from the battlefield and from the bodies of men who were wounded; wedding rings, thimbles, spoons, the remains of swords, bayonets, cannon and rifles, jewelry, coin and plate, and the pennies of more than a quarter of a million of American boys and girls.

This bell is the outcome of an idea of the Sons and Daughters of the Revolution, and commemorates the celebration of this Columbian year. There are some inscriptions on the bell: "Proclaim liberty throughout all the land unto all the inhabitants thereof," "A new commandment I give unto you that ye love one another," and "Glory to God in the highest and on earth peace, goodwill toward men."

The Tiffany Chapel in the Manufactures building is a grand exhibit. The altar is made of white mosaic inlaid with mother-of-pearl and jewels. The columns and windows are all of mosaic glass, in the style of the thirteenth century. The cross on the altar is of gold set with jewels. The altar window has a setting of peacock feathers in gold and natural colors. There are 280,000 pieces in the altar, which glisten in the subdued light of the candles which are kept burning on the altar.

WASHINGTON'S RED CEDAR VASE.

In the Washington building at the World's Fair is exhibited the largest piece of wood turning in the world. It is the work of J. L. Nygren, of Tacoma, an employe of the Tacoma Lumber and Manufacturing Company. Mr. Nygren spent about three months of his time making a special lathe and turning from a single log of cedar a huge vase, six feet high and four feet across the top. The vase is highly polished, and shows to splendid advantage the coloring and graining of the red cedar.

World's Fair Awards.

In the Department of Artistic Manufactures the judges have passed upon nearly all of the exhibits, and medals have been awarded to many foreign as well as home exhibitors. The list is so long we can only find space for the American medalists as follows:

New York—Brown's Amber Manufacturing Company, Bell & Barber, Leon Favre, M. J. Powers, Beyer & Schultzer, Tiffany Glass and Decorating Company, Tiffany Glass and Decorating Company, S. Strauss & Sons, Tiffany Glass and Decorating Company, Tiffany Glass and Decorating Company (5), S. Klober & Co., Tiffany & Co., Ed. Jansen, Sypher & Co., B. & W. B. Smith, Ed. Jansen, Hertz Bros.

Chicago—Columbus Manufacturing Company, Winslow Bros., Healy & Millett, Wells Glass Company, Miss M. Heinnermaux, L. M. Hamline & Co., Mrs. W. M. Clarke, Mrs. B. B. Jinkins, F. Winter Co., Miss S. R. Little, A. E. Richter, Gensch & Hartman, E. B. Clarke Co., J. C. Wemple & Co., Winslow Bro. Co., Ehman & Simon Manufacturing Company, Bensinger Bros., Wind Folding Bed Co., Th. Kane & Co., George E. Androvetti, Rawson & Evans, McCully & Miles, Flanegan & Beidemorg, Horn Bros., Henry Dibblee Co., Dean & Co., A. H. Andrews & Co., American Bronze Company.

Providence, R. I.—F. F. Pearce & Co., Gorham Manufacturing Company (several), O. C. Devereaux & Co., R. L. Griffith & Son, S. & B. Lederer, Reynolds & Co., J. H. Fanning & Co., New England Manufacturing Company, Arnold & Steere, Charles F. Prons, Payton

LARGEST TURNED VASE IN THE WORLD.

& Kelley, W. E. Webster & Co., Kent & Stanley Company, Otsby & Barton.

Philadelphia—William Reith, J. W. Boughton, William Galloway.

Toledo—Libby Glass Company, Gendron Iron Wheel Company.

Boston—H. R. Plimpton & Co., Derby & Kilnor Company.

Denver, Col.—Miss J. R. Pickney.

Lyons, N. Y.—Manhattan Silver Plating Company, Manhattan Silver Plating Company.

Meriden, Conn.—Meriden Britannia Company, Meriden Britannia Company.

Newark, N. J.—Whitehead & Hoag, Stewart Hartshorn Company, Nymble.

Geneva, N. Y.—Miss F. Crittenden.

Kansas City, Mo.—F. D. Koehler.

East Liverpool, O.—Knowles, Taylor & Knowles, Knowles, Taylor & Anderson.

Cincinnati, O. — Reuld Moulding Manufacturing Company, Andrew Messwell & Co.

Phœnix, Ariz.—F. E. White Cactus Manufacturing Company, F. E. White Cactus Manufacturing Company.

St. Paul, Minn.—Drake Manufacturing Company.

Grand Rapids, Mich.—Gun Folding Bed Company, New England Furniture Company, Sligh Furniture Company, Royal Furniture Company.

Milwaukee, Wis.—Miss A. S. Lodge.

Freeport, Ill.—G. Dickens Filigree Company.

Allegheny, Pa.—Conroy, Puigh & Co.

Rockford, Ill.—Royal Mantel Company, Middlecomb Company, Rockford Standard Company.

Hartford, Conn.—Wm. Rogers Manufacturing Company (3).

Attleboro, Mass.—R. F. Simmons & Company, W. & S. Blankington.

Bridgeport, Conn.—Holmes & Edwards Silver Company.

New Bedford, Mass.—Pairpont Manufacturing Company.

Washington, D. C.—Mary and Emily Healy.

Detroit, Mich.—George Le Roff.

Columbus, O.—Kimmear & Yager Company.

Pittsburg, Pa.—U. S. Glass Company.

Trenton, N. Y.—Burroughs & Mountford Company.

Baltimore, Md.—Edwin Bennett Pottery Company.

Pawtucket, R. I.—G. H. Fuller & Son.

Miscellaneous.—J. Hoare, William K. Potter, Aladdin Terra Cotta Company.

The Money of the World.

Acting Director of the Mint Preston has prepared a table of the monetary systems of the world. The table shows that the aggregate stock of gold is $3,582,005,000; silver, $4,042,700,000; uncovered paper, $2,635,873,000.

Stock of gold possessed by principal countries is as follows: United States, $604,000,000; Great Britain, $550,000,000; France, $800,000,000; Germany, $600,000,000; Russia, $250,000,000. The stock of silver is as follows: United States, $615,000,000; Great Britain, $100,000,000; France, $700,000,000; Germany, $211,000,000; Russia, $60,000,000.

The stock of silver is divided as follows: United States, $538,000,000 full tender, and $77,000,000 limited tender; Great Britain, no silver full tender, $100,000,000 limited tender; France, $650,000,000 full tender, $50,000,000 limited tender; Germany, $103,000,000 full tender and $108,000,000 limited tender; Russia, $22,000,000 full tender and $38,000,000 limited tender.

The ratio prevailing in nearly all principal countries between gold and legal tender silver is 1 to 15½. The ratio between gold and limited tender silver is, as a rule, 1 to 14·38. The respective ratios in the United States are 1 to 15·98 and 1 to 14·95.

The various monetary systems as divided among countries: Gold and silver—United States, France, Belgium, Italy, Switzerland, Greece, Spain, Netherlands, Turkey, and Japan. Gold—United Kingdom, Germany, Portugal, Austria, Scandinavian Union, Australia, Egypt, Canada, and Cuba. Silver—Russia, Mexico, Central and South America, and India. Of the uncovered money, South America has $600,000,000; Russia, $500,000,000; United States, $412,000,000; Austria, $260,000,000; Italy, $163,000,000; Germany, $107,000,000; France, $81,000,000; and Great Britain, $60,000,000.

The per capita circulation of gold is: United States, $9.01; United Kingdom, $14.47; France, $20.52; Germany, $12.12; Russia, $2.21. Per capita of all classes of money is: France, $40.56; Cuba, $31.00; Netherlands, $28.88; Australia, $26.75; Belgium, $25.53; United States, $24.34; United Kingdom, $13.42; and Russia, $7.16.

The Ruins of Ang-Kor.

Recent events have attracted attention to the great lake between Cambodia and Siam, Toule Sap, and to the two Siamese provinces of Ang-Kor and Baltambong which adjoin it. A few months ago the *Progres de Saigon* issued an account, illustrated by native wood engravings, of this great lake of the two provinces and of the famous ruins of Ang-Kor. The region is described as lying to the north of Cochin-China, between Siam, the ocean and the unknown Laos districts, and although now but thinly populated, it was in former times the abode of a race which was great among the peoples of the East, and which for long centuries was governed by a famous line of sovereigns. The great lake is formed during the rainy season by one of the branches of the Mekong, and is then navigable by large steamers, which go to Siemreap, at the head of the lake, and near the ruins of Ang-Kor, the greatest remains of Khmer civilization. These ruins were discovered by the Portuguese and Spaniards in 1564, and they were first described in a volume published in Barcelona in the following century. There are Chinese accounts of a much earlier period, and one of these, written in the thirteenth century by an ambassador sent to the Cambodian court, was made known to Europe by Abel Remusat. It includes descriptions of the two famous temples of Ang-Kor Wat and Ang-Kor Thom, which correspond with the ruins of the present day. Since then they have been investigated by French savants, and quite a splendid work on the subject has been published by M. Fournereau. It is thirty hours' steam to Pnom-Penh, the capitol of Cambodia, and thirty more to Siamreap. Ang-Kor Wat, or Ang-Kor the Great, the royal pagoda, is the best preserved of all the Khmer remains. Mouhot, who visited it in 1862, says it is more majestic than any other monument of antiquity that we possess. It occupies a large rectangular park, 1,087 m. long and 827 broad. The illustrations show numerous towers, vast terraces, several subsidiary temples, innumerable figures of fantastic mythological animals, galleries, colonnades, avenues, lakes, bridges, etc. The surface of the large stones employed in the buildings are covered with pictures and engravings. These huge blocks are believed to have been conveyed to the great heights at which some of them are found by means of inclined planes. Ang-Kor Thom, which is a few miles away, is still more ancient, and around it are the ruins of the old Khmer capital, Preathong, which have been invaded by the forest, giant banyans having their roots below the foundations and their branches among porticoes and pillars covered with bass-reliefs. These latter, which are especially well preserved in the underground galleries, represent the national sports, sacred ceremonies and historical events of the Khmers. These are the two main Khmer monuments, but there are hundreds of others scattered over a large area of the country in the midst of what looks like a primeval forest.—*The Architect.*

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Correspondence.

Plumbago as a Lubricant for Steam Cylinders.

To the Editor of the Scientific American:

The engine on which the experiments were carried on was a compound duplex, high pressure cylinders 14 × 12 and low pressure cylinders 20 × 12, with a piston speed of 200 feet per minute.

To obtain the best results, the common oil cup was exchanged for a goblet-shaped tallow cup, with a lid; after which, the piston follower and springs were taken out and cleaned before starting the engine. One-third ounce of finely pulverized plumbago was placed in the cup. When fairly under way the valve of cup was opened half way, and a little later was opened to its full extent.

The piston rod became coated with plumbago soon after starting, and by noon the whole had passed from the cup into the cylinders.

On starting up, in the afternoon, one-third of an ounce more was placed in cup, and the engine run till five o'clock with like result. There was no noise in cylinders, either in starting, running, or stopping the engine, and after two months' use, with the above amount twice a day, no noise has been heard in cylinders. Soon after beginning its use, a small amount of plumbago was left in cup. To obviate this, one ounce of water was poured in cup after the plumbago was put in, and a decided improvement was observed, in that it could be fed into the cylinders as readily as oil.

After three weeks' use, the cylinder heads were taken off and the working parts were found coated with plumbago, so it could not be easily rubbed off with the finger.

EARL GAINER.

El Reno, O. T.

Cooling Air by Means of Underground Pipe.

To the Editor of the Scientific American:

Can you give us any information as to the construction of a cold storage apartment, which is built by means of sewer pipe being laid a certain depth below the ground, and for a certain length through which the warm air passes, and by the time it reaches the apartment is sufficiently cooled, so as to dispense with the use of ice? The cool air is then carried away through a high chimney. We are informed that cold storage apartments are being built on this principle, and any information you may be able to give us as to their construction and practicability will be highly appreciated.

THE ZOAR SOCIETY.

Zoar, O., July 29, 1893.

[The cooling of air, as indicated by our correspondent, has been proposed; but we do not call to mind any practical example now in operation. The principle seems correct, but the power of a natural circulation appears weak. The air, when it becomes cool in the subterranean pipes, is disposed to stay there, like the air in wells and cellars, and unless some positive means are employed to produce a fixed condition of circulation, the apparatus would be of little value. The natural draught of a chimney, without heat, is as liable to be downward as otherwise. Again, if artificial draught is produced, it should not be in excess, as a strong draught through the subterranean pipes would soon warm the passages and ground and destroy its cooling properties. Under any circumstances, the amount of cooling effect must be small, as the temperature of the ground in summer, at a depth of four feet, is seldom cooler than 55° Fah. In order to obtain a temperature of 60° in hot weather, the subterranean exposure should be very large; we should judge not less than one square foot for every cubic foot of space in the cool room, with a moist ground for the unglazed tile pipe. Then, if four inch tile pipe is used, it will require 1,000 feet for a cool room of 10 feet × 10 feet × 10 feet, which may be divided into two or more sections leading in different directions. In very dry ground, we should judge that fifty per cent more pipe should be used. For artificial draught, a small fan driven by electricity, a wheel train and weight, which may be wound up by a small windmill, will be the most available power; otherwise an up-draught ventilator may be made available when there is any wind. The use of fire for creating draught in the chimney will be troublesome and expensive, unless the cold room chimney could be warmed by a flue used for other purposes. The more porous the tile pipe can be made, the better results will ensue, as it must absorb the water of condensation from the cooling air and also be a partial feeder of air from the ground.—ED. S. A.]

Lemon Sirup.

Take 1 pint and a quart of juice, 2 pounds of sugar. Let the juice stand in a cool place to settle. When a thin film is formed on the top filter the juice, add the sugar, and finish in the bain-marie. If the flavor of the peel is desired with it, grate off the yellow rind of the lemons and mix with the juice to infuse, or rub it off on part of the sugar and add it to the remainder when you finish it. Orange sirup is made in precisely the same manner as lemon sirup.—*Western Druggist.*

THE RORDAME COMET.

The accompanying diagram will give the unscientific reader some idea of the relation between the paths of the comet and earth. Suppose the circle representing the earth's orbit to lie in the plane of the paper, then the comet's path lies in a plane inclined 20° to that of the paper and intersecting the latter in the line NN′, which is called the line of nodes.

About June 26 the comet passed the point, N, its ascending node, and since that time its path has been north of the ecliptic. On July 7, it reached its nearest point to the sun, and at almost the same time its nearest point to the earth. It was discovered therefore at the time of its greatest brightness, when it was almost directly between the earth and the sun, but at some distance above the line joining the two. The tail of the comet was directed toward a point almost directly over the earth.

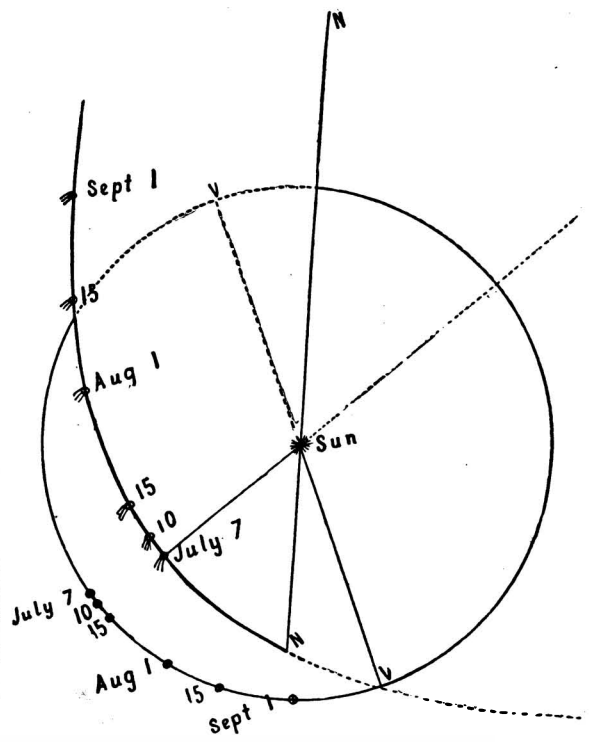


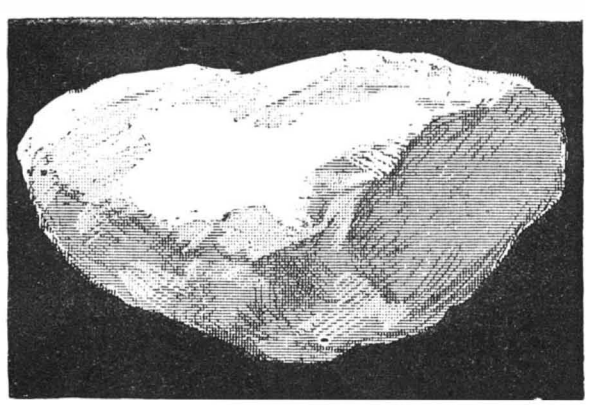
DIAGRAM SHOWING RELATIVE POSITIONS OF COMET *b* 1893 AND THE EARTH.

The apparent motion of the comet among the stars was very rapid, because of its nearness to the earth. This has been rapidly decreasing, as might be expected from the fact that the earth and comet are moving in opposite directions. Its course has been southeastward, passing by the feet of the Great Bear and between Leo and Coma Berenices. During August it moved very slowly southeast from a point 5° east of the star β Leonis toward the double star γ Virginis. —*A. and Astro. Physics.*

A MONSTER DIAMOND.

We have received from Birmingham the plaster of Paris model of the great South African diamond, recently found in the Orange Free State, and which is claimed to be the largest ever discovered. The model was sent to the editor of the Birmingham *Daily Post* by Mr. Walter Lowe, a Birmingham man, now resident in South Africa. In a letter which he sent with the model, dated Jagersfontein, July 2, he says:

"You may have noticed by cable that the largest diamond the world has ever seen has been found here. This place is all excitement about it, and it may make a stir in the financial world. I am sending by this post a perfect plaster of Paris model of the diamond, which was found on June 30, 1893. This model was taken by me personally this morning, and is the only one which has been taken except one which I have sent this afternoon to the President of the Orange Free State, by special request. The diamond was found in the New Jagersfontein Company's mine. It is the most perfect large stone ever seen, its weight is 971 carats, its color is blue-white, and almost perfect. It has one black spot in it, which, however, the owners stated to me will cut out. Its value, of course, cannot now be stated; but I think if £50,000 were offered for it now, or even double that amount, it would not be accepted. Some even declare that it will be worth half a million. It was found by a Kaffir, who was working in the mine, shortly after blasting. The Kaffir, in this case, was talking to his overseer, when he saw something shine, and he put his foot over it until his 'boss' had gone away, when he picked up the immense diamond and put it in his pocket. Afterward, in the compound, he handed it over to the manager, for which he has been given £150, a horse, saddle, and bridle, and has gone home in, no doubt, perfect happiness. An extraordinary circumstance is that one gentleman, or some gentlemen, I don't know which, were under contract to buy all stones, good, bad, or indifferent, at so much per carat. This contract terminated on the 30th of June, and this stone was almost, if not quite, the last stone found on that day."



"The Largest Diamond in the World:" The "Jagersfontein Excelsior," recently discovered in the Orange Free State. (Exact Size.)

The model shows that the stone is in the form of a sloping cone flattened on two sides, and standing on an oval base, so flush as almost to appear to have been cut. Its height is about three inches, and its width about two, while the flat base measures nearly two inches by one and a quarter. The diamond itself, which has been named the "Jagersfontein Excelsior," is now in London.—*London Daily Graphic.*

Seaside Painting.

A paper was recently read on this subject by Paul F. Brazo before members of the Master Painters' Association of New Jersey. The author said:

I will relate what I have observed, experienced, and practiced for the past thirteen years on the ocean front at Long Branch.

In the first place we have to contend with a great amount of dampness and fogs, which always leave a residue of salt on the surface of the work to be painted or otherwise treated. So it follows that we must be on the alert to know that the work is perfectly dry; especially new work. It was only after I had several jobs badly blistered and spoiled that I concluded to seek a remedy, and my remedy was this: To leave all piazza ceilings, floors, and clapboards under piazzas and porches until ten o'clock, or later, in the day, if possible to do so. I have followed this rule, and have had no trouble in that direction since.

As to the salt on the surface of the work—where it was practicable, and the work was not to be hurried, I had it washed thoroughly a day or so before applying the priming coat. I then primed with pure lead, used thinnings composed of one-third turpentine and two-thirds raw oil, with one-half pint of good japan to the gallon, in shade of color as near to the finishing color as possible. My object in keeping the priming the same shade as finishing is that it makes the work more solid, and as the priming coat has to stand at least three days or more before applying the finishing coat, and as it generally makes its own color, or, in other words, the priming darkens, it follows where we put on finishing there is just enough difference to be perceptible and comfortable to work over without showing brush marks, etc.

I have also observed that a combination of pure lead and French zinc is the best, using good japan and raw oil only as a binder. For finishing coats, the zinc and lead should be in the proportion of 25 per cent and 75 per cent pure lead—no pulp lead—as we have all the moisture on the surface that is necessary. At all times I use the French zinc, for the reason that it does not contain sulphur to such an extent as our American zinc, consequently does not bleach my coloring matter so quickly.

I particularly avoid using ochers or other earth paints, except in priming coats, for I have observed that all buildings where ocher was used as a stainer, no matter what grade it was, or what lead was used in combination with it on the sea coast, were in all cases attacked with the painters' worst enemy—mildew; particularly when painters were foolish enough to use boiled oil as a means of conveyance. On the contrary, I have observed that lead, zinc, chrome yellow, and their kindred pigments, with raw oil and japan as a binder are not molested by mildew, and that they wear longer, hold their luster better, and instead of bleaching in spots and mildewing, will wear uniform; in fact, grow darker in course of time, and in all cases give your customers good satisfaction.

I have noticed that all, or nearly all, of those who come here from the cities or from towns away from the coast use boiled oil, and that all of their work goes wrong in the first six months, and makes a difficult job for the painter who follows them to do good work.

A word about shellac work in our damp air may do some fellow craftsman good. Do not do any shellacking in the early morning. If you must do it in damp weather, or in the early part of the day, have your men take a piece of cheese cloth, dampened with raw oil, and rub dry, and the work will not turn white, as I see some of the cottages at present which I have been called in to remedy; that is if you cannot varnish immediately after shellacking, or if a shellac finish only is required.

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THE NORTHERN DIVER AT THE LEIPZIG ZOOLOGICAL GARDEN.

I was very much pleased at the beginning of June to see, for the first time, the northern diver (*Colymbus arcticus*), which had just arrived at the zoological garden of Leipzig. The bird has a very characteristic appearance, owing to its strong neck and head, and particularly the strange arrangement of black, white, and gray feathers, which is of a very striking beauty, and may be clearly seen in the principal figure of the cut, so that a further description is not necessary.

This extraordinary bird is very attractive, not only in appearance, but in its movements and habits. It is very interesting to see the bird, which but exceptionally leaves its natural element, the water, swimming and immersing its body more or less at will, which movement may be due to a particular action of the lungs. This ability of the bird can be observed in a very striking manner when the bird dives or swims below the surface. The bird rushes through the water at an appalling speed. It seems as if it could not swim slowly when fully immersed in water, and I could observe this very well, as Mr. Pinkert, the proprietor of the zoological garden, put the bird into a glass bowl, so that I was able to see it from the side, as shown in the small view, No. 3. It will be noticed that the bird swims with extended neck, tightly closed wings, and widely spread legs, employing the latter to propel itself under water. It is very interesting to see that nature achieves the same result in a quite different way in the lumme (shown in view No. 4), which swims under water with its head drawn back, the legs extended rearward and serving only as a rudder, while the wings are used after the fashion of fins. Both these aquatic birds follow their prey into the water, and their fish-like appearance is adapted to deceive the prey.

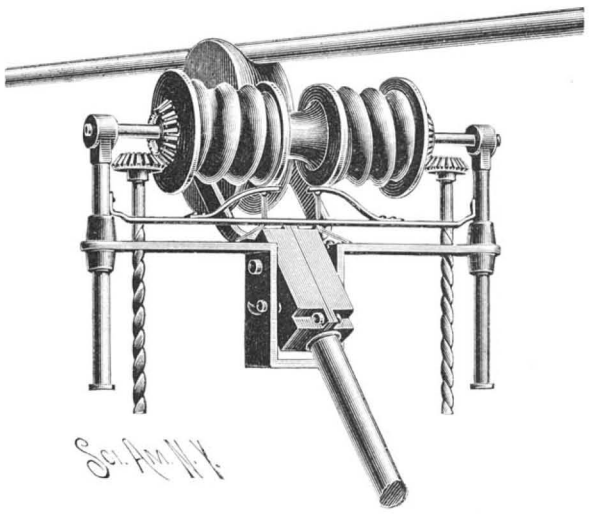
Though very agile in water, the northern diver is very clumsy on the land. The legs are so near the end of the body that the bird is unable to stand or walk. It can only crawl on the ground, and I have often seen it in the posture shown in view No. 2, sitting on the shore; but it never remained out of the water but for a very short time.

It is well known to ornithologists that the northern diver is a good flier, notwithstanding its comparatively small wings, and the bird I had the opportunity of seeing shows indications of this ability by agitating its wings, so as to almost rise out of the water (view No. 1), which probably is the manner it starts to fly from the water when it is in liberty.

The name of the bird already indicates that it is an inhabitant of the northern regions, and it only occasionally appears on the German shores, where it is but seldom caught—generally in the nets of fishermen. The bird is fully the size of a large domestic duck, and the opportunity of studying its appearance and movements has been particularly valuable to me, as the ornithological reports on this bird are rather meager. Want of space has compelled me to give but a short description of this rare and beautiful animal. —*H. Leutemann, in Illustrirte Zeitung.*

A TROLLEY WIRE FINDER FOR ELECTRIC RAILWAYS.

A simple apparatus is provided by the improvement shown in the illustration for use with the ordinary trolley and pole of electric railways, whereby, on the trolley leaving the wire, it will be automatically re-



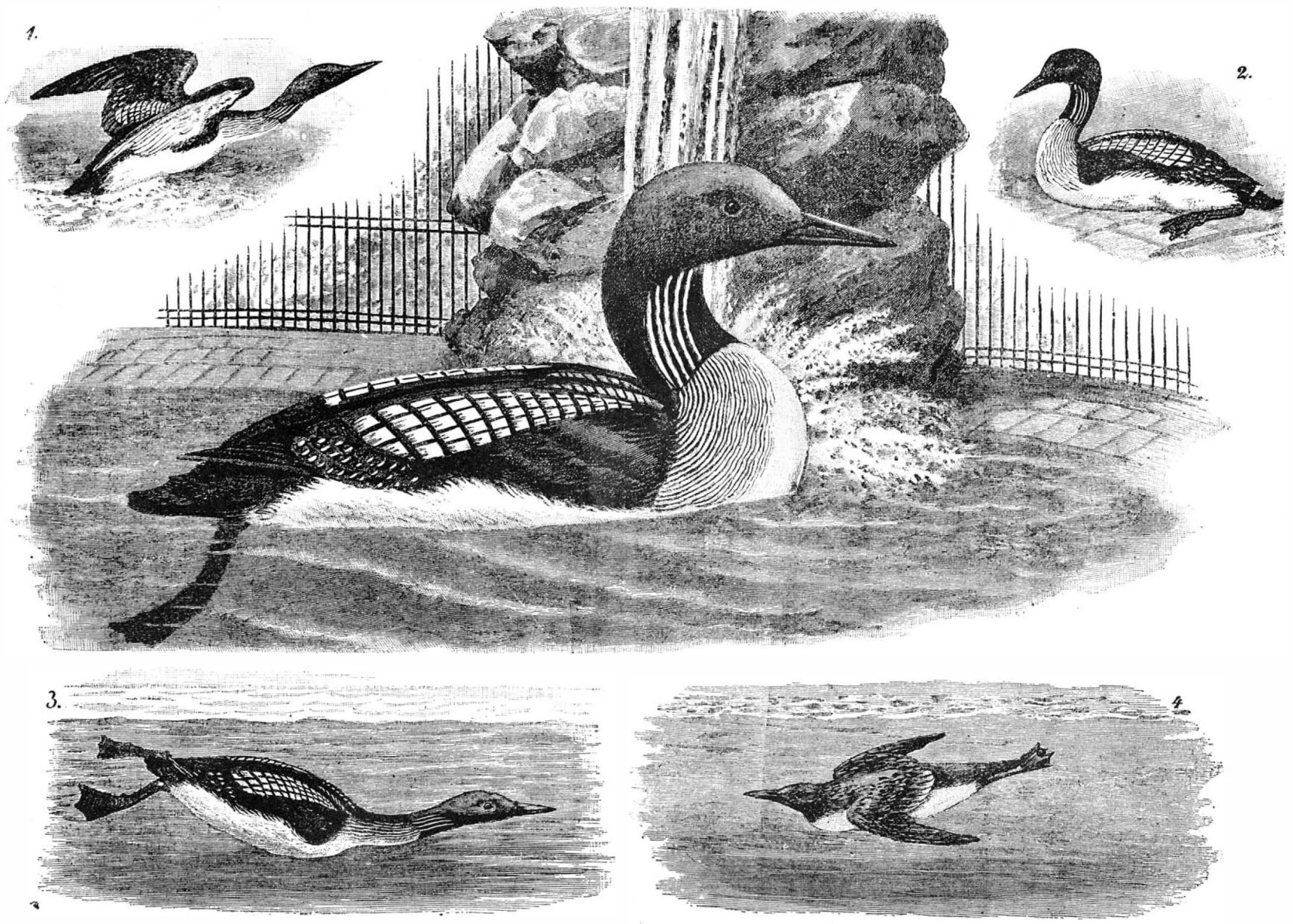
JONES' TROLLEY WIRE FINDER.

turned to its proper position. The improvement has been patented by Mr. Henry C. Jones, of Montgomery, Ala. (box 285). On the trolley pole, beneath the wheel contacting with the line wire, are clamps having outwardly projecting studs, which support the crossbar or bracket of a guide, the bracket being held in a vertical position by set screws projecting from the clamping pieces through a curved slot in a central depending portion of the bracket. At the outer ends of the bracket are sleeves, through which extend vertically movable posts affording bearings for a cross shaft, on each side of which are secured spools with spiral threads running toward the center, where they connect with a loosely running guide pulley. Washers arranged between the spools and pulley, and normally projecting above their meeting edges, prevent the wire from sliding upon the pulley until the guide has been raised sufficiently to permit the transfer of the wire to the guide pulley and the main trolley wheel. To effect this, the outer ends of the spools have bevel gears meshing with gears on the ends of vertical screw shafts turning in threaded bearings in the bracket, whereby the friction of the wire as it turns the spool raises the guide, the wire at the same time being carried inward by the groove of the spool. The washers between the spools and pulley have central openings permitting of the vertical movement of the washers, which are normally pressed upward by springs. The lower edges of the washers and the free ends of the springs are connected by short chains, also secured to the bracket, which limit the upward movement of the spools and posts when the guide has been raised to the proper height. The pitch of the screws of the vertical screw shafts is such that, when the wire has been transferred to the main trolley wheel, the weight of the spools and other mechanism will cause the screws to turn back, permitting the guide spools to drop to their normal lower position.

The Valiant.

Mr. W. K. Vanderbilt's new yacht the Valiant is a veritable floating palace. The Valiant is of 2,400 tons measurement, 312 feet in length, 34 feet beam, and is propelled by twin screws, each driven by a 2,250 horse power engine. The yacht was built by Laird Brothers, of the Birkenhead Iron Works. The interior fittings of the beautiful vessel are not quite finished. Some of the doors, for instance, are merely primed and will remain so until the vessel reaches Nice, when she will be decorated. The metal work throughout the vessel is a silver alloy called Wilson's white metal. This metal stays very brilliant with little care. The saloon and library are fitted up by Messrs. Cauel, of Paris, in the most expensive style. The saloon is 18 feet long and is 34 feet in width. The design is Louis Quatorze, worked out in white and gold; the furniture is in the best Chippendale style, inlaid with brass, and is upholstered in crimson silk velvet. Each stateroom, and there are twenty, has a bathroom connected with it, and no two rooms are decorated alike. A hundred foot passageway, arched and beautifully decorated, connects the library with the saloon. The library is finished in dark unpolished walnut. Mr. Vanderbilt's stateroom is covered with special designs in Tynecastle tapestry. The wall spaces are paneled in light blue, with floral designs of rich blue silk.

The Valiant left Liverpool August 16 and reached New York August 25, with her sailing master, Captain Henry Morrison, and a crew of sixty-two men. The Valiant is the property of an English syndicate, and among the five or six stockholders are Mr. Vanderbilt's private secretary and the sailing master. Of course this English syndicate is entirely controlled by Mr. Vanderbilt, and it is shrewdly surmised that the company was formed only to avoid annoying custom regulations.



THE NORTHERN DIVER AT THE LEIPZIG ZOOLOGICAL GARDENS.

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THE WORLD'S COLUMBIAN EXPOSITION—A VIEW ON THE GRAND SOUTH CANAL.

We illustrate a view taken from the head of the Grand South Canal, looking north. It is a remarkable scene. Both the North and South Canals abound in picturesque architectural effects, but the view here given transcends them all. In front, at the right, rises a reproduction of the noble Egyptian monolith, Cleopatra's Needle, in Central Park, New York. Even the hieroglyphics are included, while the base of the obelisk is guarded by four spirited lions, the work of Mr. M. A. Waagen. Between the obelisk and the splendid Palace of Manufactures, on the right, will be seen one of the Roman rostral columns, decorated with the prows or beaks of galleys and surmounted by a statue of Neptune. The Palace of Manufactures, owing to its great size, could not be made so ornate as some of the smaller buildings; but the problem of erecting an immense exhibition structure without sacrificing all beauty of form and proportion has been successfully solved by the architect, Mr. George B. Post. The roof of this gigantic building affords the best coign of vantage from which to view the manifold beauties of the great White City. Access to the roof is had by means of the electric elevators. On *fête* days, when the building is decorated with flags and pennants, the contrast of the warm color of the bunting with the pure white of the exterior is superb. Beyond the bridges, which are beautifully proportioned, is the Wooded Island, above which rises the dome of the Illinois State building.

The Palace of Electricity will be noticed at the left, just beyond the second bridge. Messrs. Van Brunt & Howe, of Kansas City, were the architects. The effect of the Corinthian pilasters and the campaniles is very fine, repetitions of the electro-magnet and lamp are freely used, as well as conventional ornament. The south front, facing the Court of Honor, is broken by a great hemicycle, in which stands Carl Rohl-Smith's statue of Franklin. At the extreme left is seen the central and cornerpavilion of the Palace of Machinery—a very successful composition in the best style of the Spanish Renaissance. Messrs. Peabody & Stearns, of Boston, were the architects. The North and South Canals are embellished by many fine pieces of sculpture.

THE WORLD'S COLUMBIAN EXPOSITION—A VIEW ON THE GRAND SOUTH CANAL.

Increase of the French Navy.

The French naval estimates for the year 1894 contemplate, says *Engineering*, the laying down of no fewer than thirty-two new vessels of various types, viz.: Three first class battleships, five second class cruisers, one third class cruiser, one sea-going torpedo boat, five first class torpedo boats, four second class torpedo boats, nine torpedo launches, one second class dispatch boat, and three gunboats. The battleships, which will be built two in the dockyards and one by contract, will have a displacement of 11,000 tons and engines of 14,500 horse power, giving a speed of 18 knots. The armament of each will be four 11·8 inch, ten 5·5 inch, six 3·9 inch, sixteen 1·85 inch, ten 1·45 inch, and eight revolving guns. The second class cruisers, one of which will be built in a government yard and four by contract, are of two types. The first type, which is to include the vessels provisionally known as E4, E5, and E6, will be of 3,990 tons displacement, 9,000 horse power, and 19 knots speed, carrying four 6·2 inch, ten 3·9 inch, fourteen 1·85 inch, and four 1·45 inch quick-firing guns. The second type, which is to include the vessels provisionally known as G3 and G4, will be of 3,800 tons displacement, 9,100 horse power, and 19·25 knots speed, carrying six 6·2 inch, four 3·9 inch, eight 1·85 inch, and twelve 1·45 inch quick-firing guns. These five vessels are improved Chasseloup-Laubats. The third class cruiser, which is to be built in a government yard, will be a modified Galilee, of 2,300 tons displacement, 6,600 horse power, and 20 knots speed, carrying four 5·5 inch, two 3·9 inch, eight 1·85 inch, four 1·45 inch quick-firing guns, and four revolving cannon.

The sea-going torpedo boat, which will probably be built by M. Normand, of Havre, will be a repetition of the Forban, which is now under construction, and will be of 3,260 horse power and 30 knots speed. She will measure 144 feet long. The first class torpedo boats will be of 80 tons displacement, 1,350 horse power, and 23·5 knots speed. The second class torpedo boats will be of 53 tons displacement, 700 horse power, and 20·5 knots speed. The torpedo launches, which are intended to be carried on the deck of the new torpedo depot ship Foudre, will be 62 feet 4 inches long, displacement 14 tons, having engines of 210 horse power, and being capable of a speed of 16·3 knots. It is expected that they will be built at Creusot, where the plans have been prepared. The gunboats, of which particulars are not made public, are believed to be river gunboats for colonial service.

A Costly Fair Exhibit of Platinum, etc.

The exhibit at the World's Columbian Exposition of Messrs. Johnson, Matthey & Co., of London, is valued at over $100,000, and besides iridium, ruthenium, rhodium, osmium, palladium, pure and in various combinations, includes a remarkable and very valuable display of platinum, of exceptional purity. The international standard meter and kilo, as adopted after long experiment by the Paris International Commission, is from an alloy made by this firm of platinum 90 per cent, iridium 10 per cent, and eminent experts reported the platinum of a degree of purity heretofore considered commercially impossible, being 999·98773 per 1,000. In making the standards, 8,000 ounces, troy, were employed. Various forms of platinum apparatus are also shown, that for the concentration of sulphuric acid being especially interesting.

Metric Equivalents.

The metric nomenclature is coming into such common use, especially in scientific articles, that the following formulas will be found valuable:

WEIGHT EQUIVALENTS.

To convert grains into grammes multiply by	0·065
To convert grammes into grains multiply by	15·5
To convert drachms into grammes multiply by	3·9
To convert ounces (avoir.) into grammes multiply by	28·4
To convert pounds (avoir.) into grammes multiply by	453·6

MEASURE EQUIVALENTS.

To convert cubic centimeters into grains multiply by	15·5
To convert cubic centimeters into drachms multiply by	0·26
To convert cubic centimeters into ounces (avoir.) multiply by	0·036
To convert pints into cubic centimeters multiply by	473
To convert liters into ounces (avoir.) multiply by	35·3
To convert gallons into liters multiply by	3·8

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Intelligence of Birds and Animals, Especially those that are Susceptible to the Cholera and Contagious Diseases.

BY NICOLAS PIKE.

The intelligence of animals now claims, more than ever, the attention of the naturalist. Many believe that most of them possess, to a certain degree, the faculties of man, and there is no doubt that there exists an intimate connection between the organization and the intellectual faculty. Dr. Lindsay, in an essay which he published, and which has excited some attention, takes the ground that the mind of the lower animals does not differ in kind from that of man, and that they possess the same affections, virtues, moral sense, and capacity for education, and are liable to the same kinds of mental disorders. If we should study them more closely than we do, the conclusion which many scientists like Lindsay have arrived at would enable us to fix in our minds these facts without a doubt. It is said that birds are very susceptible to the cholera, and oftentimes fly from this much dreaded disease. As the cholera has been much dreaded the past season, it would be well for the ornithologist and scientist to watch these birds and some of the lower orders of animals, and confirm what is accredited to them in relation to this disease.

In the year 1854, the cholera appeared at Mauritius, an island in the Indian Ocean. It was in a violent form, and the inhabitants became much alarmed, as the deaths ran up to the frightful figures of two hundred and fifty a day in the city of Port Louis, with a population of eighty thousand persons. During this pestilence there were many reports about the disease being conveyed to fish, flesh, and fowl, which was doubted by many persons, and it was considered merely a whim of the large population of Indians, who are very superstitious. But when accounts began to accumulate from men of veracity it became a fixed fact, and generally believed, that birds were leaving the city and suburbs, particularly one called the "mina," *Paradiseus tristes* (Cuvier). This bird was formerly introduced into the island from Pondicherry for the purpose of destroying an insect which was troublesome. It became numerous, more so than any other species. They assemble in vast numbers in undisturbed woods and thickets, but show a decided fondness for the proximity of human habitation. They may be seen going out in the morning and returning in the evening, like rooks, but do not fly in large numbers together.

Mr. George Clark, a government schoolmaster, residing at Mauritius, informed the writer of the result of his investigation, which can be relied upon, as he was an excellent naturalist, close observer, and a reliable man. In speaking of the "mina bird," he thought it a most remarkable fact that they should leave the city of Port Louis while the cholera was raging, both in 1854 and and 1856. Such was a fact, and he knew it to be true, and his statements were confirmed by many persons from different parts of the island. The keeper of the large cemetery near the city of Port Louis stated that the birds used to be very numerous before the outbreak of the cholera. Scon after the disease appeared in the city the birds commenced to leave, till not one could be found in the large grove of trees which surrounds the grounds. When the violence of the disease had much abated they began to return, but were not so numerous as usual, till it had entirely disappeared. Captain Rupel and a number of prominent gentlemen of veracity confirmed the statements. During my residence at Mauritius I conversed with many persons in relation to the above, and all testified to the fact that the statement was true, and that some of the fresh water fish were affected and died. This I do not state as having come under my own observation. We have well authenticated accounts that during the terrible epidemic of cholera which almost entirely destroyed the inhabitants of the town of Basse Terra, Gaudaloupe, some years ago, the cats and many birds left the place, for parts unknown, and did not return for some weeks, till the disease abated. Some of them remained away permanently. A similar case happened at Malme, in Sweden, on the approach of cholera in 1834.

The Boston *Herald* published a short account of a statement of Major C. C. Creagh, of H. B. M. Regiment "The Royal County Downs." He states that he was present during the unusually severe visitation of the cholera in the town of Kurrachee, in Sinde, in 1846. His regiment lost, in the space of ten days, about two hundred and forty men, and it was particularly remarked that the vultures and other birds of prey entirely disappeared almost simultaneously with the outbreak of the cholera, returning generally after the first few days, when the virulence of the disease began to abate. Major Creagh also mentioned a singular circumstance, from which it would seem that the inhabitants of the sea are by no means exempt from the mysterious disease. On the second or third day after the appearance of the cholera, the bay to the south of Kurrachee was strewed with myriads of dead fish, which were left on the beach by the receding tide. At high water the shores of the bay presented a most singular appearance. The waves for several yards from the shore seemed to be composed of an almost solid mass of dead fish, chiefly of the sardine species, among which, however, there were not wanting others of considerably larger size. This belief in the prescience of birds is almost universal in India, and it is imputed to their power of diving into the secrets of futurity. It is common to the kites and the lizards, and has been acknowledged by some in all ages.

We are aware that there are thousands of persons who watch the migration of birds and note their departure from our northern clime to that of the more genial south; also the hibernation of animals, the time of their entering the hibernaculem, as this denotes an early or late winter. The early flight of wild geese denotes a storm or an early spell of cold weather. The people of Africa, India, Japan, and China watch with interest the movement of birds. The natives of Ceylon, when about to make a journey of two or three days, are governed by a certain bird. They proceed to the woods and seek this bird. If there is to be a change in the course of twenty-four hours, the bird will be found perched on the topmost branch of the tree, pouring forth his melodious notes, which indicates rain, and, it is said, never fails to come. The natives of Ceylon have the most implicit confidence in this sign.

In the warm days of July the cat bird may be seen perched on the low branches of the dogwood tree, uttering peculiar low notes, which are always sure indications of a thunderstorm in the afternoon or evening. These notes are never heard except at this time. We were acquainted with a celebrated statesman who informed us he had never known this to fail, and had the most implicit confidence in this sign. Dr. Meyer says he has never seen birds oil their feathers from their oil glands in order to secure them from rain; but he has seen many do so when the weather was overcast, and when there were indications of rain. It is said that the English robin is termed the naturalist's barometer; for on a summer's day, though the weather may be rainy and unsettled, he sometimes takes his stand on the topmost twig that looks up to the sky, or on a housetop, singing cheerfully and sweetly. When this is observed it is an unerring promise of succeeding fine days. Sometimes, though the atmosphere be dry and warm, he may be seen, melancholy, chirping, and brooding, in a bush or low hedge.

Bears, wolves, and other animals scent the coming rain. The wolves set up a terrible howling, and, raising their heads, point their noses in the direction in which it is coming, oftentimes twelve hours or more before it falls.

The large Gallapagos tortoise always searches for a place under cover, into which he may go twenty-four hours or more before the rain falls. At one of the islands of the African coast which I visited there was a large tortoise farm, where they were breeding these animals for food. On a bright, clear morning not a cloud could be seen, everything indicated a bright, warm, clear day. Nearly all the tortoises in the inclosure were heading in one direction, toward some overhanging rocks, where there was a pen. The proprietor informed me that rain would certainly fall during the day, and, sure enough, it came down in torrents in the afternoon. These animals, and I believe all the family, have a great antipathy to rain drops falling upon their carapaces. The expression of animals which show a pre-sensation of rainy weather may be explained, partly from the increasing weight of the atmosphere, partly from their manner of living, and partly from the want of moisture, which is necessary to their existence.

Man, in a sound state of health, is subjected, on the approach of stormy weather, to heaviness of body and mind, a want of capacity to perform his usual occupations, a yawning and relaxation, which are highly disagreeable. These are accompanied also with a sensation of heat. The high flight of birds, which hasten to the upper regions of the atmosphere, is because they are freer from vapors and more suited to them, and because the lower regions, being more loaded with vapors, afford them less pleasure than those above, also the insects which they pursue for food take then, perhaps, a higher flight.

At a meeting of the members of the French Academy, held at Paris in July, 1850, evidence was shown that during the prevalence of the cholera in France, in the district of the city of Paris where the disease was most prevalent, it was noticed that the horses became uneasy and were affected with the disease in a like manner with man, and that often, in the case of other epidemics, a common liability of men and horses had been noticed. Horses surely have a reasoning power. They become attached to each other, especially to their keepers, if kindly treated and petted.

Here is a remarkable instance which occurred but a few months ago, showing the intelligence of the horse. Lieut. Robertson, of the Royal Engineers, was attacked by the Ghazi of Gullston, India. It appears that the former was riding and was joined by the Ghazi, who was on horseback. Both entered into friendly conversation and shortly afterward put their horses to a trial of speed, in which Lieut. Robertson outstripped his rival, when the Ghazi, being a short distance behind, suddenly drew his tulwar and inflicted a severe gash on Lieut. Robertson's neck, and otherwise wounded his hand, which he had raised to ward off the Ghazi's attack. Lieut. Robertson was brought into Quetta, and taken to the station hospital, where he is at present being treated. The young Ghazi was arrested and identified by Robertson, and his guilt proved, was tried, and sentenced to be hanged and his body afterward burned. The sentence was carried into effect at once.

It is stated that when Lieut. Robertson fell from his horse and was lying on the ground bleeding profusely, the faithful animal protected his master from further injury by kicking at the Ghazi and attempting to bite him. But for this remarkable behavior on the part of Lieut. Robertson's horse, it is supposed that the Ghazi would have probably hacked Lieut. Robertson to death.

There are many instances of cats, that had been made pets of, deserting the house at the time of sickness and death. One case came under our own observation, that of a full-blooded Maltese cat, who was a great favorite of the lady of the house, and was fond of lying on a cushioned chair when she was reading or sewing. The lady was taken suddenly ill, and was removed to her room. On the day this took place, the cat left the house, and remained away for ten days. No one knew where she was hiding. During this time the lady died, and was buried. It was some days before the cat became reconciled to the absence of its mistress.

The great intelligence of the archer fish, *Chelmo rostratus*, is really wonderful! It swims near the banks of streams in search of prey. As soon as an insect is seen on the overhanging branch, he at once fills his mouth with water, and throws it out in a small stream with such great precision that he seldom misses the object, and it falls into the water and is instantly devoured. The Chinese keep these fish in confinement and amuse their friends by placing live insects on a bough over the water so that they may see the great intelligence of the fish.

The gouramie builds a nest for its young and will defend them with its life; is a remarkably intelligent fish. I have had them in confinement, and would frequently call them from their hiding places among the rocks in a large basin, and they would come and feed from my hands.

The stickleback of our own country is an intelligent and wonderful fish in many respects. They build a nest for their ova, and will not allow any other fish to come near it.

There is a species of the belone or garfish called aiguille that deposits its spawn in a way, so far as I know, that is very singular and unique. It selects some floating body, to which it attaches the end of the long membrane in which the ova are enveloped, and then it winds off just as a person winds cotton thread round a spool or any other substance. I have seen several bodies thus coated, some of which had a length of fifteen or sixteen feet, in which the eggs, many thousands in number, about the sixteenth of an inch in diameter, were interspersed. This depositing the ova is effected by the fish leaping over and diving under the body on which it deposits its spawn. I have seen a common wine bottle completely covered with spawn floating on the ocean.

From what is here shown of birds and animals evincing a fear of the terrible disease the cholera, may it not be caused by something in the atmosphere that affects them the same as it affects man, and may not the great intelligence given them by their Creator who governs everything cause them to flee from malarial districts, and other places, which are injurious to them. Intelligence in animals I think one of the most wonderful gifts of the Creator.

There are many instances which we could record of higher degrees of intelligence that would be impossible to deny, that animals arrive at a knowledge of cause and effect.

THE great steamships plying between Australia and England are provided with freezing machinery, by which mutton, frozen, is preserved and delivered in London in fine condition. Australian flowers preserved in ice are also carried to London. Recently at a special meeting of the committees of the National Chrysanthemum Society held in London, some frozen blooms of chrysanthemums sent from Sydney, New South Wales, were exhibited. Four large incurved and other Japanese blooms, inclosed in great blocks of ice, 18 inches square and 8 inches deep, had been sent by Mr. R. Forsyth, of Sydney, a well known grower, and were a portion of the group with which he gained the silver cup of the Sydney Horticultural Society in April last. These fine examples of the perfection to which the British gardeners in Australia have brought the Chinese and Japanese flora were shipped to England on the P. and O. steamer Ballarat, and, after being stored at Messrs. Sweeting's and the Cold Storage Depot at Blackfriars, were sent to the Aquarium and there unpacked.

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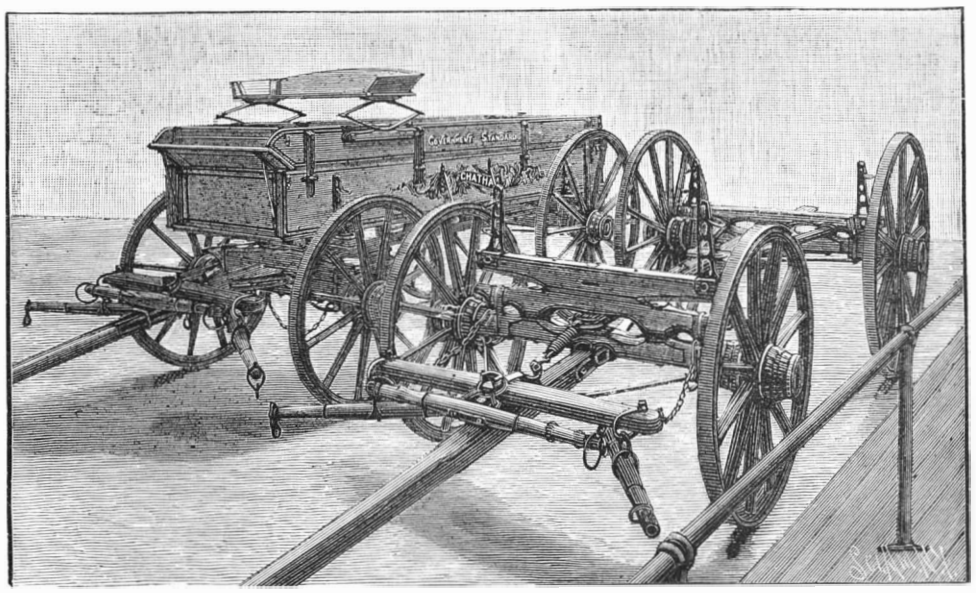
HEAVY WAGONS SHOWN AT THE FAIR.

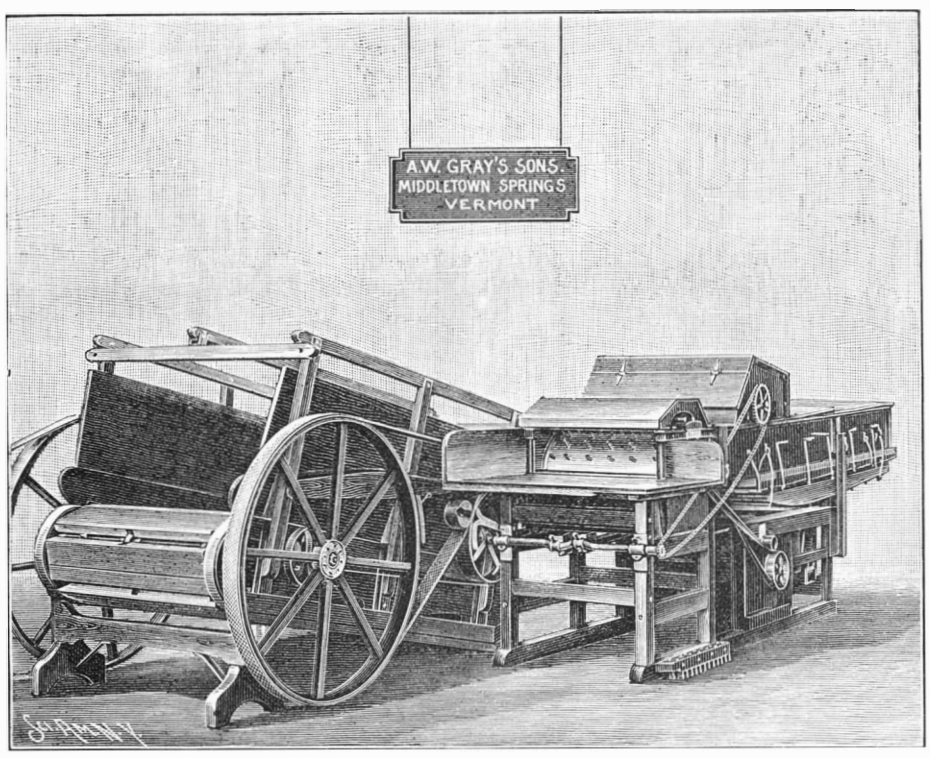
In the display of wagons for heavy work at the Exposition, the exhibit of the Chatham Manufacturing Co. (Limited), ofChatham, Ontario, Canada, occupies a prominent position, and has attracted much attention. These wagons, though not so tawdrily got up as some, are among the best and most mechanically constructed of any wagons shown for the hard usage such wagons get in actual service. The exhibit consists of one "Chautauqua Giant" farm wagon gearing and one complete "Chatham Giant" wagon, there being used on both the peculiar style of arms or thimble skeins patented by Mr. D. R. Van Allen, the president of the company. This thimble skein or arm strengthens the axle through what was formerly its weakest portion, and practically does away with the old time breaking point of axles, also dispensing with the use of truss rods. The arm admits of the sand board and front axle and bolster and hind axle being combined, forming a complete and solid truss, the one reacting upon the other in such a way as to strengthen all the parts. By means of this improvement the wagons of the company adapted to carry the heaviest loads are yet so light that the gearings weigh only one-eighth of their carrying capacity, and the three by ten inch cast thimble skeins or arms have carried five to five and a half tons without straining. Another noticeable feature of this display is the Simpson patent malleable adjustable stake, used on wagons or farm trucks not intended for logging. These stakes on narrow track wagons are adjustable from thirty-eight to forty inches merely by slackening two nuts to a stake, admitting of very much stronger wagon bolsters, because there is no big mortise through the ends, and the iron plating on top of the bolsters runs from end to end. The upper box and seat of the complete wagon is quarter-sawed sycamore, and the lower box is quarter-sawed white oak.



THE WORLD'S COLUMBIAN EXPOSITION—EXHIBIT OF HEAVY WAGONS OF THE CHATHAM MANUFACTURING COMPANY.

A. W. GRAY'S SONS EXHIBIT OF "HORSE POWERS."

The exhibit made by A. W. Gray's Sons, of Middletown Springs, Vt., at the World's Columbian Exposition is an especially fine one in a line in which manufacturers in this country have always held a leading position. It comprises horse power, grain thrashing and wood sawing machines, the horse powers being used for running a wide variety of machinery in wagon shops, bakeries, dairies, for pumping, grinding apples for cider, cutting feed for stock, operating grist mills, etc. The planks of the platform on which the horse walks, in the horse powers, are fastened together on the under side by a steel gear, connected by steel rods, which serve as axles for rollers, moving with the platform, the gear meshing with pinions on a shaft from which power is furnished to the various kinds of machinery. The speed of the band wheel with horses walking ordinarily fast is ninety revolutions per minute. These horse powers with grain thrashing outfits may be conveniently moved from place to place to do thrashing on different farms as desired. Drag saws and machines for sawing logs, and circular saw machines, adapted for most convenient and efficient operation by these horse powers, have also been for many years a leading specialty with the firm, which was established over fifty years ago, the present proprietors having been brought up as boys in the shop. Besides having a practical familiarity with every part of the work, they have invented and perfected many of the devices in use in the machines. The illustrated catalogue which they send on application gives full detailed information of the construction and operation of the machines.



THE WORLD'S COLUMBIAN EXPOSITION—"HORSE POWERS," THRASHING MACHINES, ETC., SHOWN BY A. W. GRAY'S SONS, OF MIDDLETOWN SPRINGS, VT.

The United States Leads.

The United States is now the leading manufacturing country in the world. We have far outstripped all other nations in the magnitude of our industrial operations. It is almost incomprehensible that in ten years the increase in capital invested in manufactures should exceed the total invested only twenty years ago. The value of our manufactured products increased about 60 per cent; add 60 per cent to the output of 1890 and we would have $12,700,000,000 in 1900—but that is too much to expect. The same rate of growth in mining interests in this decade as in the last would make our mineral output in 1900 nearly $1,200,000,000, while a smaller percentage of gain, only equaling in volume the total increase in 1890 over 1880, would bring the figures to over $950,000,000. If our coal miners add to the output of 1890 as many tons as they added to that of 1889, ignoring in this the percentage of growth, 317,000,000 tons will be the production of 1900. No other country in the world ever advanced in population and wealth as the United States is doing. The progress of the past shows no signs of halting. In fact, the development of our foreign and domestic trade and commerce and of our industrial interests is steadily broadening out.

Contrast our position and condition with Europe; with resources surpassing those of all Europe, with wealth-creating possibilities in soil, minerals, timber, and climate unequaled by Europe, and practically without limit to their profitable utilization, with a homogeneous population of 65,000,000 people unvexed by the arbitrary regulations of half a dozen different governments, and free from the drain of standing armies, the United States justly commands the wonder and admiration of the world.

Great Britain is no longer the manufacturing center of the world, for we have taken the foremost position in that line. Its vast iron and steel business is yearly increasing in cost of production, while ours is decreasing. It cannot meet the world's growing demand for iron and steel, because it cannot increase its production to any great extent. It produces less pig iron now than it did ten years ago. Much of its ore it imports from distant countries. Its cotton is all imported. It spends about $750,000,000 a year for foreign foodstuffs. On the Continent every nation is burdened with debt, and none of them can hope to pay off its obligations. Measured by their natural resources and advantages for continued growth against their debts, and the many disadvantages under which they labor, they are practically bankrupt. In all of them the cost of production and living must steadily increase. In the United States we have scarcely laid the foundation for our future greatness. In natural resources we are richer than all of Europe; we are paying off our debts faster than they are due, we have barely scratched the ground in the development of our mineral wealth, and our agricultural growth can scarcely be limited.—*Engineering Magazine.*

Manila Sugar.

In a paper on the Philippine Islands by Mr. H. A. McPherson, and published in *The Sugar Cane*, it is stated that the canes of that country are very rich, and that with better appliances the product, which is now very poor, might be made equal to any in the world. Agriculture is carried on almost entirely on the metayer or share system, the owner of the land providing the implements, animals, machinery and seed, and the produce is divided between the owner and the laborer, and it is said that the latter rarely gets a fair share. The laborer is generally in debt to the landlord for advances and there is usually a balance against him at the end of the year. The landlord, however, also suffers in the same way, he working on borrowed capital, advanced by local capitalists.

The cultivation of sugar is practically confined to four islands, Luson, Panay, Negros and Cebu, the first supplying what is known as Manila sugar, the second and third Ilo Ilo and the last Cebu sugar according to the ports from which it is shipped. None of the sugar is of very high grade, owing to the absence of high class machinery. Each district produces what is called dry and wet sugar, the former being divided into various grades. The Manila sugar is what is called clayed, which means that after the juice is boiled in open pans the mass is poured into an earthenware receptacle like an inverted cone and a thin layer of liquid mud is then put on top, the moisture of which gradually percolates through the mass, washing the molasses from the crystals and carrying the bulk of it through an aperture at the bottom into earthern jars below. After standing for some weeks or months, the sugar is ready for further manipulation on the dry grounds, which are entirely in the hands of the Chinese, who purchase the raw material from the planters. When they are opened the sugar is almost white at the top and gradually becomes darker toward the bottom; the white and dark sugars are mixed together in certain proportions according to the grade which is to be produced. It is then spread on mats to dry in the sun, for which one day is sufficient in dry, hot weather. When dried, it is packed in mat bags and is ready for shipment.

The Brown Wire Gun.

First Lieutenant G. N. Whistler, U. S. A., gives some interesting details in regard to the Brown segmental wire-wound gun, over the tests of which, on August 25, at Sandy Hook, he presided. The muzzle velocity was 2,875 foot seconds. The muzzle velocity of 2,875 feet per second, Lieutenant Whistler says, shows a muzzle energy of 3,557 foot tons, or 856 foot tons per ton of gun. This is the highest record, he declares, ever obtained with any gun. The muzzle energy per pound of powder is 169 foot tons, according to Lieutenant Whistler, and which, he says, has never been exceeded so far as he knows in a 45 caliber gun under similar conditions of loading. The gun which was tested fired a projecilte weighing 62 pounds. The gun is a 5 inch weapon, 45 calibers long. This is 5 calibers longer than the most high-powered ordnance rifle now in use in the navy. Long calibers are unhandy, particularly at sea; but the increased calibers length insures a longer and more thorough burning of the powder, so that the chances of unignited grains of powder being thrown out are reduced to a minimum. The record of the Brown wire gun, so far, shows that the projectile fired with Leonard smokeless powder would penetrate 16·08 inches of wrought iron.

IN New York all the bonded warehouses are at present packed solid with foreign goods, waiting the improvement of the times, there being now comparatively little demand for such merchandise.

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Some Egg Hatchings.

BY C. H. BENNETT.

Some years since, by way of recreation, I became interested in microscopy, and, having secured a suitable outfit, I decided to turn my attention along the line of entomology and kindred subjects. Having a wide-range battery of objectives, including several high powers, I was prepared to observe the minutest forms of organic life, and had soon trespassed (my work was so unsystematic and unscientific that I can but call it trespassing) on the field of insect oology. My ambitious watchfulness soon made me quite expert in gathering and mounting a variety of eggs, ranging in size from silkworms' to mosquitoes'. Each new acquisition yielded a rich harvest of delight, for my microscope revealed a diversity in size, form, color, and markings fully equal to those larger varieties we are accustomed to find in the nests of birds.

I had frequently noticed on the flanks and legs of horses that were not thoroughly groomed a profusion of bot fly (*Æstrus equi*) eggs, and, awaiting the proper time (August), I picked from the legs of a patient nag a number of hairs each ornamented at the end with one of these minute yellowish specks, with a view of submitting them to microscopic examination as a means of satisfying my curiosity. No sooner had I focused my instrument on these almost invisible objects than they instantly developed into forms of most marvelous beauty.

So entirely unique were they, differing from anything that had previously come under my observation in every detail, that I at once determined to mount them for preservation. I therefore carefully folded them in a bit of paper and placed them in my pocket, where they remained a month before I found leisure to mount them. On removing them from the wrapper I once more placed them under the microscope, that it might assure me they were just as I left them a month before.

Convinced that they were in their normal condition, I then proceeded to arrange them in an orderly position before sealing them in their crystal tomb, and, to make it less tiresome for my eyes, I condensed the light of the lamp on the objects with an ordinary reading glass.

While thus manipulating them I was annoyed by a slight motion among the hairs to which the eggs were attached, and turned my breath away, under the impression that it was the cause of the disturbance. This, however, seemed to make no difference in the embryonic commotion, and for a moment I was thoroughly mystified.

Without waiting for further developments of a spiritualistic nature, I again appealed to my microscope to satisfy my curiosity. Placing the whole collection under a two-thirds objective, I was inexpressibly delighted to see fully one-fourth of the larvæ in the very act of opening their shells. It instantly occurred to me that in using the reading glass in arranging the eggs I had not only condensed the light, but also the heat of the lamp sufficiently to produce the wonderful result which my faithful microscope had revealed.

It is needless to add that I lost no time in hermetically sealing the objects of my delight in the glass cells prepared for their reception, where all signs of life soon ceased; and, as a result of this simple accident, I have a slide showing part of the eggs unopened just as they were gathered, while others show the grub with his head and half his body protruding from the shell.

It may also be interesting to the young student of nature to know that the egg of the bot fly is not broken at all in hatching. The grub simply pushes a cap or lid from one end of his little cell and crawls out. Indeed, the shells are so strong that I have found it quite impossible to crush them between thumb and finger.—*The Outlook.*

Animal Vocabularies.

A good deal has been said about the probable existence of definite vocabularies in the language of the lower animals, and I believe one has gone to Africa to study simian speech. This is all well enough, but there is no need of going beyond the barn yard to hear a definite animal vocabulary of a considerable number of words. Hear the rooster's warning cry when he sees or hears indications of danger. It is a definite sound, and perfectly understood by every hen and chick. Drop food to the mother hen. She quickly inspects it, and if approved, tells the little ones to eat, by uttering her well known "Coot, coot, coot!" If she decides that it is not fit to eat, she as plainly tells them to let it alone. The other day a green worm fell from a tree near a brood of chickens. Every chick ran to seize the morsel. The mother gave one quick glance at the insect and said, "*Skr-r-r-p!*" Every chick stopped instantly. But one willful child, loth to believe his mother's assurance that it wasn't fit to eat, would make him sick, etc., started a second time, to pick up the worm. "*Skr-r-r-p!*" commanded the hen sharply. Even the willful child obeyed this time, and the whole brood walked off contentedly. Discuss as we will the particular reason for the hen's cackle before and after laying, the fact remains that it is a definite utterance, as plainly understood by both gallinæ and homines as any expression in human speech.

My horse has a low whinny which means "water," and a higher-keyed, more emphatic neigh means food. When I hear these sounds I know as definitely what she means as if she spoke in English. This morning, passing along the street, I heard that same low whinny and, looking up, saw a strange horse regarding me with a pleading look. I knew he was suffering from thirst, and no language could make it plainer.

The language of the lower animals is not all articulate. It is largely a sign language. The horse does a deal of talking by motions of the head and by his wonderfully expressive looks. He also, upon occasion, talks with the other extremity. A peculiar switch of the tail and a gesture, as if threatening to kick, are equine forms of speech. The darky was not far wrong who said of the kicking mule, "It's just his way of talking!"

The dog can not only "look volumes," but can express whole sentences by wags of the tail more readily than can the waving flags of the signal corps. All that is necessary is to learn his code. We expect our domestic animals to learn our language, and punish them cruelly if they fail to both understand and obey our commands; yet, notwithstanding our higher intelligence, we fail to learn their language, by means of which we might better understand their wants and dispositions, and thus control them by kindness and sympathy, instead of by harsh and arbitrary treatment. I see horses passing along the street, which are saying by every look and motion that they are suffering acute torture from a too short check rein. Their drivers are often people who would be shocked if they could comprehend their own cruelty. But they do not understand horse language, and some of them do not seem to have horse sense.

The language of animals is a neglected subject. The facilities for its study are within the reach of all, and no previous preparation is required. The study can be pursued without interfering with other occupations, and even a little systematic observation will bring large returns in both pleasure and profit.—*Charles B. Palmer, in Science.*

How to Preserve Cut Flowers.

In the hot, dry days of summer one often finds the flowers in vases, although freshly gathered, in a drooping condition, the result, it may be, of plucking them at the wrong hour, or of improper attention afterward. They who would keep their bouquets bright and vivid throughout the day should rise betimes, for there is no freshener like the dew of the morning, whether for blossom or complexion. Poppies, fleeting and frail, if plucked before the sun has dried the dewdrop at their hearts, and quickly placed in water, will last sometimes for two days without falling, and the same is true of other tender garden flowers. Should the basket of cut flowers show signs of drooping, dip the bunch head downward into the water and give it a gentle shake. This is very efficacious in reviving flowering shrubs brought from a distance, when they become wilted before reaching home.

The Japanese have made a special study of this branch of the art of flower arrangement, and have special rules for different plants. If the wistaria is to be used in decoration, its cut stem is burned and then immersed in spirits. The hydrangea and the lespedeza should also have the cut ends burnt to charcoal before immersing in water. All flowers which suck up water with difficulty are improved in vitality by treating the ends of their stems with fire or hot water. Land plants derive benefit from burning, but water plants require boiling water.

When the Japanese use the bamboo in decoration, which is their frequent custom, they cut it at a very early hour, four in the morning, and remove the bottom division or knot, leaving the upper division untouched. They then fill the tube with fifty-eight grains of cloves stewed in hot water and seal up the bottom. It is then laid horizontally until the liquor inclosed is cool, after which it is ready for use. When the colored maple is employed, the leaves are immersed in water for an hour before using. The very dark red ones are particularly hard to preserve, but the lighter ones are more enduring. The willow has its cut stems spliced off and then bound up with a drug they call senkin, the branch afterward being left in water overnight.

The morning glory, of which the Japanese make great use, is carefully cut in the evening after the flowers are tightly closed. The sleeping buds are then gently wrapped in soft paper by their dexterous fingers, and this is not removed until the following morning, when the arrangement is made. Begonia Evansiana should be cut in the early morning, the buds removed with a sharp knife, and the whole immersed in water before arranging. Monochoria vaginalis, when cut, should have about one inch of the end immersed in hot water until the color changes, and it must then be dipped deeply in cold water, after which it is ready. The same treatment is applied to Senecio Kaempferi.

The prickly poppy (Argemone Mexicana) is treated by having its stem tightly tied around with soaked paper at a point five or six inches above the cut end. This end should then be burnt with a flame, after which the paper is removed, and the flower is ready to use. The yellow water lily (Nuphar Japonicum) should be selected from a shallow spot, and cut during the heat of the day. A liquid composed of cloves boiled in tea should then be blown into the cut stem, and thus the vitality of the flower is prolonged. Whether this treatment is also desirable for the white pond lily, Mr. Conder, who is my authority for Japanese practices, does not state, but it would be worth while to experiment, if thereby this lovely flower could be longer retained in perfection.

The great Japanese irises, if cut while in bud, will open freely in water, and last longer than if allowed to open out of doors, where the sun promptly wilts their beautiful blossoms and curls the tender petals almost before they have expanded. Nasturtiums, too, suffer from being gathered while the sunlight is hot upon them, but in the early morning, with the dew still damp upon their leaves, they can be found nestling in the shadow with half-open heads just in the right condition for our vases. The fragile heliotrope plucked at this hour will retain its freshness, whereas if culled when the sun lies fierce upon it, it will droop and turn black in the shadiest parlor.

Flowers and plants wilt because water is transpired by leaves and petals more rapidly than it is taken up through the stem. On a dry, hot day leaves and flowers often wilt on the plant. Even when not actually wilted they may contain barely moisture enough to hold them in shape, and when cut under these circumstances they wither at once unless they are put into water instantly, when they will often become more plump than they were before cutting. The stems of plants when cut begin immediately to change structure, and form a callus at the wound, which interferes with the absorption of fluids. It is advisable, therefore, to cut the stems off a second time while under water, so that all the channels through which water rises may be without any obstruction. As there are many substances besides water in the juice of plants, some of these odd Japanese practices may have some value. At least, they are worth trying.—*M. C. Robbins, in Garden and Forest.*

Tempering Mainsprings.

For some time past an Illinois concern has been engaged in a series of experiments in tempering mainsprings with a view of reducing the defects in their manufacture to a minimum. As the result of these experiments, a new process has been devised which is said to make these small springs almost perfect. Thin sheet steel rolled to a suitable thickness for the manufacture of the desired spring is split into ribbons, considerably wider than the finished spring. They are then carefully and solidly wound on arbors against a face plate, so that they resemble solid disks. The face plates are then placed upon a lathe and the edges of the spring ground until all cracks, no matter how minute, have been removed, leaving the wound ribbon a perfectly smooth and polished disk of metal. The other side is treated in the same way, and the result is a ribbon of thin steel perfectly solid on its edges and the same thickness throughout.

As the thickness of a mainspring is between 0·008 and 0·009 of an inch, the degree of heat at which this bit of steel will take a proper temper is a fine point. To secure the even temperature required, a clever electrical apparatus has been invented. A vertical tube, thoroughly packed by asbestos to prevent its being affected by the outer air, is heated by means of an electric current, which is governed by a rheostat to regulate the temperature. An opening at the top of this tube is just large enough to admit the steel to be tempered. At the lower end of the heating tube is placed the chilling bath, which is supplied with oil from a pipe, the flow being steady and even. By an ingenious arrangement, the oil is fed to the bath on both sides of the moving ribbon of steel at the same time, thus subjecting every part of the wire to a uniform chilling temperature.

The metal passes through the heating tube into the chilling bath without exposure to the air, the intervening space between the tube and the chilling medium being covered by a second tube with an air-tight connection, which forms a muffle. In this way there is secured a ribbon of steel without cracks on its edges or scales on its surface, perfectly even and straight and of uniform temper. As the wire is heated by radiation and has no opportunity to become oxidized, "pitting" is altogether prevented. Experts speak highly of this new process, and it would seem as if the days of the perfect watch spring were near at hand.—*Bos. Jour. Com.*

OLD SPRUCE FOR VIOLINS.—The ancient Hammond house in Marblehead, Mass., is being torn down, and some of its spruce timbers, which have been protected from rain and wind for more than 200 years, are being eagerly sought after by violin makers for use in the manufacture of their instruments.

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RECENTLY PATENTED INVENTIONS.

Engineering.

STEAM BOILER.—Philip J. and Fred. W. Doll, La Salle, Ill. This is an upright tubular boiler, with tubes leading from the fire box in the lower part of the casing to a smoke box in the upper part below the water line. The smoke box is shaped like the frustum of a cone, and supports a conoidal bonnet of cast iron, which does not radiate much heat and may be easily removed when burned out, the smoke box proper being protected by the water, and the products of combustion therein assisting to generate steam. The boiler is designed to be inexpensive, extremely durable, and very effective.

FURNACE DOOR.—Charles W. Reneau, Meridian, Miss. The door opening, according to this invention, has a lining provided with transverse ribs on its sides, whereby air spaces are formed between the sides and the wall of the opening, and the door itself has an air inlet and an air space opening into the air spaces at the sides of the lining, a shield covering the interior opening of the lining. The sides and ends of the door lining are made separate, to facilitate replacing any of the sections as they may be burned out, without disturbing the others.

MOTOR.—Frank W. Clark, Mount Desert, Me. A vertical shaft connected with the machinery to be driven has a forked upper end supporting a plate engaged by a shaft provided with a weighted arm and adapted to swing, the upper end of the latter shaft being journaled in a swinging lever and pressed upon by springs. The device is designed to uniformly transmit motive power, through a continuous rotary motion, from the driving machinery to machines to be driven.

VALVE.—Thomas P. Ford, Brooklyn, N. Y. This is an improvement on a former patented invention of the same inventor, providing a valve of simple construction which works automatically to introduce a lubricant when the pump is running. The invention compries a valve carrying a piston controlled by fluid pressure, and a lubricator having a valve controlled by the piston, so that when the valve is seated the lubricator is shut off, and when the valve is unseated the lubricator feeds the lubricant.

Electrical.

CONDUIT FOR BUILDINGS.—James J. Powers and Robert Van Buren, Brooklyn, N. Y. This is a conduit of baked clay forming an integral part of the wall, floor, or ceiling, and is of built-up sections, each having apertures to receive wires, collars around the apertures at one end of a section being received in recesses at the opposite end of each section. The conduit may be placed in a building and the wire omitted for any length of time, the sections being made of suitable proportion for laying along with the brick in a wall, and left unglazed on the exterior, with a rough surface to adapt it to receive and hold mortar. The construction admits of readily changing the wiring when necessary.

ELECTRIC BELT.—Adolf Stephenson and Jonas Backstrom, Stromsburg, Neb. This is a belt to be worn on the person for remedial purposes, and is formed of elastic webbing, with a lining of flannel, provided with a series of studs or buttons of copper and zinc, the metals alternating with each other, and the larger portions of the buttons being in contact between the flannel linings and the elastic webbing. The shoulder straps connected with the belt are also provided with similar buttons, the convex portions of which are in contact with the skin when the belt is worn, and there being electrical connections to complete the circuit.

Miscellaneous.

TREATING REFRACTORY ORES.—Charles J. Fauvel, London, England. This is a method of treating ores having precious and other metals, to oxidize and eliminate the associated sulphur, arsenic, antimony, and tellurium compounds, by subjecting the crushed ore in a fine, free-falling stream to increasing degrees of radiant heat and a reversely flowing current of hot air and steam, out of reach of contamination with the furnace gases, the particles of incandescent ore being then quenched in cold water to split up the particles, remove scale, and generate steam to assist the oxidizing and desulphurizing action of the air. The improved process is preferably carried out by means of a furnace formerly patented by the same inventor.

MAKING SULPHURIC ACID.—Francis B. Hacker, Charleston, S. C., and Peter S. Gilchrist, Baltimore, Md. A sulphuric acid apparatus is provided by this invention with improved connections between the several lead chambers, the lead chambers and the Glover tower and between the chambers and the Gay Lussac tower, to reduce the usual chamber space and cost of plant, increase the quantity of acid, carry off the excessive heat caused by the mixing of the gases, and provide for the quick and thorough mingling of the gas molecules as they pass from chamber to chamber.

SHUTTER WORKER.—Thomas N. Lupton, Winchester, Va. This invention provides a simple and compact construction whereby the shutter may be opened or closed from within the room, and locked and unlocked in both its open and closed positions without requiring the window to be opened. A shaft extending through the window frame, and provided with a handle within the room, has a connection with the hinge of the shutter involving a novel construction and combination of parts, whereby the shaft may be easily turned to open or close the shutter. The construction is such that the shutter may be easily lifted off when necessary.

WOOD TILE FLOORING.—Antonio Salvatico, Garessio, Italy. The tile, according to this improvement, is preferably of wood, and may be of any desired shape or thickness, the tiles being laid close to one another at their upper faces, and tongued and grooved on their edges, and also grooved or channeled on their lower faces in such manner as to receive a cement or glue to hold the blocks firmly on any bed prepared to receive them, the engagement between the tiles and their support being such that the floor will be practically soundless.

CLOTHES POUNDER.—Samuel and Frederick G. Davis, Las Vegas, New Mexico. This is a device having a circular, apertured, bell-shaped body, not to be used as a pounder, but to be alternately pressed down upon and raised from the clothes, forcing and drawing the water through them, the action being facilitated by the arrangement of the air chamber and holes, so that a brisk circulation is kept up as long as the device is operated, thus washing or rinsing the clothes without injuring them.

OVEN DOOR.—Walter R. Webster and James Hamilton, Pine Grove, Cal. This is a door with a window, especially designed for stove and range ovens. It is so made that the edge of the glass will be kept comparatively cool, and the whole body of the glass will be evenly heated, and thus prevent breaking. With this view the glass is supported and held in an asbestos or other non-conducting flexible packing, in such manner as to allow for its expansion and contraction, while a free circulation of air is provided for around the edges of the glass, which nowhere comes in direct contact with the metal.

REED PUFF FOR FURNITURE.—Charles Bush, Newburg, N. Y. A strong, durable, and inexpensive ornament for furniture is provided by this invention. It is a reed puff fabric made by clamping a series of reeds around a former to bend them into proper shape, and while the reeds are so clamped beveling their inner faces at the ends, finally flexibly connecting the beveled ends of the series. The construction is such that a piece of the fabric of suitable length may be made to inclose a rod or other part of a piece of furniture and form an ornamental puff or figure thereon.

HOLDER FOR CUFFS, ETC.—Richard Katzer, Brooklyn, N. Y. This is a compact case of durable construction more especially designed for the use of travelers, for conveniently holding cuffs, collars, scarfs, neckties, handkerchiefs, etc. Supported on its folding or bellows sides is a series of longitudinal partitions forming separate compartments for the articles to be stored, which are thus kept in a flat condition, room being provided for a large number of articles without rendering the holder bulky.

BICYCLE.—George F. Case, Medina, N. Y. A spring-cushioned connection between the frame of the machine and the driving wheel is provided by this invention, to render the riding more comfortable over a rough road, while the driving wheel is held at all times in proper alignment with the frame with which it is connected.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

SCIENTIFIC AMERICAN BUILDING EDITION.

SEPTEMBER, 1893.—(No. 95.)

TABLE OF CONTENTS.

1. Elegant plate in colors, showing a residence at Greenwich, Conn., erected for Miss E. L. Kirtland. Floor plans and two perspective elevations. An excellent design. Mr. W. S. Knowles, architect, New York City.
2. Plate in colors showing the Queen Anne residence of W. H. McKnight, at Springfield, Mass., erected at a cost of $11,500 complete. Perspective views and floor plans. An attractive design.
3. A colonial dwelling erected at Rutherford, N. J. Perspective view and floor plans. A model design. Cost $3,476 complete. Mr. H. G. Ten Eyck, architect, Newark, N. J.
4. A cottage erected at Bridgeport, Conn., at a cost of $2,775 complete. Floor plans, perspective view, etc. Mr. A. M. Jenks, architect, Brooklyn, N. Y. An excellent design.
5. Engraving and floor plans of a Queen Anne dwelling recently erected for W. Q. Taylor, Esq., near Boston, Mass. Samuel J. Brown, architect, Boston, Mass.
6. A cottage at Allston, Mass., erected at a cost of $2,500. Floor plans and perspective view. A pleasing design. Mr. A. W. Pease, architect, Boston, Mass.
7. Floor plans and perspective elevation of a cottage at Allston, Mass., costing about $2,000. Mr. A. W. Pease, architect, New York.
8. A tasteful design for a smithy or blacksmith shop.
9. Illustration of a new English villa at Worcester.
10. View of an Italian courtyard.
11. The Fifth Avenue Theater, New York. View showing a section of the proscenium arch and a portion of the family circle, also an engraving of the old Fifth Avenue Theater, burned in 1891.
12. Miscellaneous contents: Wood pavements.—Lead as a coating for iron and other metals.—White in house painting.—Ontario metallic paint.—Deadening floors.—Tropical roofs.—Purification of air.—Seasoning stone.—Stone under the microscope.—Housekeepers should remember.—The Climax solar water heater, illustrated.—Roofs and roof covering.—Litharge cement.—Tower supported tanks, illustrated.—Larsen's improved refrigerator illustrated.—The New York Aquarium.—Adjustable bevel-band saw machine, illustrated.—United States pitch pine industry.—The Cook patent levels, illustrated.—The Howard combination heaters, illustrated.

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References to former articles or answers should give date of paper and page or number of question.
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Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(5355) P. J. L. writes: I am making an instrument in which I wish to use a magnetic force of some distance attraction. It is desirable to have this attractive force of as even draught as possible. I find that by removing the core from a magnet (coil) I have a magnetic force exerted upon a piston head of soft iron working through this core hole which observes the center of the coil hole, but the force is weak. Will you inform me whether I can increase this force by use of a hollow iron core, and how this core should be made? Should it be a complete cylinder or be slotted or severed in the side? Should it have head on closed end? A. In Thomson's "Electromagnet" you will find the subject of obtaining a long range for a magnet discussed. In general terms use a long magnet core. The easiest way is to employ equalizing levers or cams. We can supply the book, small edition, $1; last edition, enlarged, $6 by mail.

(5356) B. C. W. says: I have an amount of steel fittings that I have to braze with brass spelter, and I have great difficulty in cleaning the borax off afterward, that I use as flux, as the work is of an awkward kind to get at. Is there any other kind of flux that can be used, or is there any kind of acid that will soften the borax in any way? A. There is nothing so good as borax for brazing. The borax can readily be dissolved and removed by boiling the articles in sulphuric acid pickle, 1 part acid, 4 parts water, in a copper pan for a few minutes, then wash with clean hot water and dip in hot soda or lime water to keep the articles from rusting.

(5357) H. C. L. asks: 1. I have heard that there is a new metal which expands more than any other. What is it called? How much would 36 inches expand to a degree of heat? A. Zinc is the best accessible metal for expansion by heat. A bar 36 inches long will expand 0·0006 inch per degree. 2. What is the price of lithium per pound? A. $1 per grain, or $7,000 per pound. 3. What is the rule to find the fifth root of a number? A. Take the square root of the cube root. It is better to do it by logarithms.

(5358) Deutsche Continental-Gas-Gesellschaft in Dessau write: Please tell us in Notes and Queries of your valuable paper the relation between the B. T. U. of heat and the calorie as being in general use in this country. We learn from an article in your contemporary, *American Gas Light Journal*, that the Pittsburg gas has a heating power of 434·3 B. T. U. of heat per cubic foot. Now, what we want to know is, how much is that in calories per cubic meter? Is it that the B. T. U. of heat means the quantity of heat needed to raise the temperature of one pound avoirdupois of water 1° Fah.? Also the relations between the electrical units used in the United States and our ohm, kilowatt, farad, and others? A. The calorie in terms of the British units is 1·8° Fah. and $2\frac{2}{10}$ pounds water, or a ratio of 1 to 1·222. Then a cubic meter being 35·31 cubic feet multiplied by 434·3 B. T. U. per cube foot $= \frac{14830 \cdot 133}{1 \cdot 222} = 12136$ calories per cubic meter. The B. T. unit being 1 pound of water raised 1° Fah. The electrical units are identical for all countries.

(5359) W. S. W. asks (1) if there is such a thing as vegetable ivory. A. Vegetable ivory is part of a nut; the nuts are a regular article of importation. 2. What can be used to dissolve it? A. It cannot be dissolved.

(5360) H. W. D. writes: Will you please inform me in your Notes and Queries the candle power of the light used in the largest of the search lights on the Manufactures and Liberal Arts building at the World's Fair, Chicago? A. The large search light on the Manufactures building gives a light equal to 45,600 candles.

(5361) B. & H. ask: Will you kindly inform us through the columns of the SCIENTIFIC AMERICAN how paper is made that the atmosphere will cause it to change color? A. Saturate paper with a solution of cobalt chloride. The color will change with the change of moisture in the air.

(5362) S. G. S. writes: 1. Please tell me what makes my well pump squeak and howl so. I am using an all-brass cylinder and only a stuffing box at top of connecting pipe, instead of a pump standard. It is attached to a windmill, and in spite of all I can do it howls whenever it moves. I thought it was in the stuffing box, but I at last located it in the cylinder. The rod that connects plunger of pump and mill is perfectly straight and no crooks in side of pipe. It has been told me that the brass being sonorous caused this noise in some kinds of water. A. The squealing of deep well pumps is generally due to the pressure of the cupped leather packing against the sides of the cylinder and possibly to hard water for the lubricant. A long connecting rod also adds to the noise by its elasticity, giving a jerky motion to the piston. 2. Can a 2½ inch cylinder draw water 1,500 feet through a 1 inch pipe when the rise is only 15 feet? A. The 2½ inch pump cylinder should draw the water through 1,500 feet of 1 inch pipe if well charged with water to start with. No more than 3½ gallons per minute can be drawn through it, from the increased head due to friction. We recommend a larger pipe, 1¼ or 1½ inch. 3. I have a range boiler back of my stove, and the tank that supplies said boiler is only about 5 feet above the top of boiler, and an air trap has formed somewhere, so at times I get no hot water in bath room. The pipes are air tight. How does this air get in and how can I get it out? How high should my supply tank be above the boiler in order to have pressure enough to overcome the air trap? A. The air in the boiler is liberated from the incoming fresh water by heat and probably accumulates in a siphon leading to the bath tub. The tank is too low and does not give pressure enough to overcome the air trap. No details of the run of the pipe being given, we cannot decide as to proper height of tank to overcome the air trap. 4. Where can I get suitable tables or books to give me the amount of friction of water in the pipes? A. Haswell's "Engineer's Pocket Book" gives details of computation for friction in water pipes, $4 mailed.

(5363) J. G. H. writes: I have a launch, hull 22 feet over all, 19 feet l. w. l., 4 feet 10 inches beam, and about 18 inches draught. I wish to fit her up for steam and would like to know the following: What horse power will I require to get a fair speed out of her, and what speed do you suppose I will get with the horse power recommended? What should be the size of engine, simple slide valve, and also size of steeple compound? I have a 4×4 simple slide valve offered me, but I did not know what horse power would be required. Also would you recommend one of the boilers mentioned in SUPPLEMENT, No. 702, which one, and how much larger it would have to be made to get the horse power required? Also the diameter and pitch of propeller for this size boat and about the number of revolutions. Also about the weight of the boiler recommended, and about what would be the extreme weight allowable for this size boat, for boiler and engine. As the boat is made of galvanized sheet iron, would ask if the hull will affect the compass? If so, how can I remedy the same? A. For power you will need 4 indicated horse power with steam at 100 pounds pressure to make 8 miles per hour. Single cylinder, 3¼ inches diameter, 4 inches stroke, making 320 revolutions per minute, propeller 20 inches diameter, set as low as possible or just under water at light load. Pitch of propeller 36 inches, 3 blade. We do not recommend a compound engine for so small a boat. It is too complicated for comfort. The 4×4 will be a good engine, if it is light and compact. It will give the required power with less pressure than 100 pounds. The boilers in SCIENTIFIC AMERICAN SUPPLEMENT, No. 702, if made large enough, would occupy too much room. A submerged vertical tube boiler, 22 inches diameter, 36 inches high above the base, 33 tubes 1½ inch, weighing about 330 pounds, which with the engine and water in boiler will bring the weight up to about 650 pounds. The iron hull and machinery will deviate the compass to a considerable extent, which will be counteracted by setting the compass within an iron ring.

(5364) Conductor, Galveston, writes: Will you kindly give a receipt for making a dip for renewing uniform brass buttons that have become tarnished? A. Remove all traces of lacquer and dirt from the buttons with strong caustic soda water. Wash in hot water and dip in strong nitric acid for from 3 to 6 seconds and immediately dip in boiling hot water, dry and lacquer while hot with thin shellac varnish.

(5365) W. G. R. asks: What horse power boiler will be required to heat a house 45×38 and ell 18×30, two stories high, and two rooms in attic 14×18? Also amount of steam pressure. How do you compute the above? Is there any way of maintaining a pressure on water pipes so as to have running water in second story without having a supply tank overhead? If so, what is it? A. Assuming that your ceilings average ten feet high and for the winter climate of Vermont, you will need a 5 horse power boiler having a fire heating surface of 75 square feet. From absence of details we assume the house to contain 50,000 cubic feet of space, which requires one square foot of radiating surface in rooms for each hundred cubic feet of space, variable according

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to exposure and situation of rooms. This will make 500 square feet of pipe surface, and the boiler should have one-eighth of the radiating surface in its heating surface, or 62 square feet. It is safe to make it 75 square feet. Pressure in water pipe can only be maintained from an overhead tank or the continued action of a pump.

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INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

September 5, 1893,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Advertising apparatus, S. Kuh 504,421
Alkaline phosphate, making, T. Meyer 504,453
Aluminum compounds, making, W. E. Case 504,324
Aluminum fluosulphate, making, W. E. Case 504,325
Amalgamating machine, J. C. Wiswell 504,508
Amalgamator, W. M. Fuller 504,678
Armature for dynamo-electric machines, J. T. Morrow 504,401
Autographic register, H. Cook 504,467
Bake pan, C. Schifferly 504,480
Bale tie, W. A. Kilmer 504,436
Baling press, G. Schubert 504,481
Band cutter and feeder, C. H. Zishka 504,383
Barrel or crate, Dare & Hall 504,445
Battery. See Secondary battery. Storage battery.
Beams, mechanism for handling, A. E. Rhoades, 504,456, 504,458
Bed, folding, J. Christ 504,328
Bed, invalid, A. Boden *et al* 504,515
Bed, invalid, Dawdy & Herren 504,333
Bedstead attachment, W. B. Carter 504,557
Belt, electric, W. C. Ekholm 504,336
Bicycle, O. W. Squires 504,633
Billiard cue tips, securing, N. Bosmann 504,663
Bin. See Flour bin.
Binder for loose sheets of paper, etc., O. Assmann 504,317
Boiler cleaner, G. E. Truax 504,426
Boiler tube cleaner, J. M. Dunn 504,569
Boiler tube closer, steam, G. C. Hicks 504,582
Book, shipping receipt, J. D. D. Mortimer 504,360
Box covering machine, W. Brandstaedter 504,551
Brace, G. S. Miller 504,604
Brake. See Car brake. Vehicle brake. Wagon brake.
Brake beam, H. B. Robischung 504,621
Brick or tile cutter, H. A. Riggs 504,364
Brick, refractory, A. E. Hunt 504,584
Bridge, cantalever, T. C. Clarke 504,559
Brush or tool holder, C. H. Lewis 504,452
Bucket and trap, combined minnow, L. W. Hemp 504,526
Bucket, lunch, L. Manguine 504,358
Buckle, harness, J. G. Hoyt 504,693
Burner. See Hydrocarbon burner.
Bushing, J. B. Snider 504,460
Button, W. L. King 504,437
Call box, H. H. Cutler 504,488
Camera shutter, O. Schramm 504,425
Can. See Measuring can.
Can bottom, W. C. Winfield 504,547
Can opener, E. B. Williams 504,381
Car brake, Anderson & Daugherty 504,313
Car coupling, J. R. Avery 504,690
Car coupling, B. F. Cadenhead 504,556
Car coupling, G. Ker 504,697
Car coupling, C. H. Taylor 504,637
Car coupling, Triplett, Jr., & Fry 504,408
Car life guard, street, T. Barnes 504,485
Car lighting system, electric, I. N. Lewis 504,681
Car mover, P. H. Jacobus 504,529
Car, railway, T. E. Pope 504,615, 504,616
Car stake pockets, die for making, N. H. Davis 504,520
Car, stock, B. C. Hicks 504,692
Car wheel, G. W. Eddy 504,416
Card flat clothing fastener, Fawcett & Jones 504,572
Cart for transporting telegraph poles, etc., J. & W. Titus 504,377
Cash register and indicator blind, L. Ehrlich 504,470
Cash registering machine, F. L. Bailey 504,409
Casting ingots, H. A. Brustlein 504,322
Cement, C. F. Le Fevre 504,477
Centrifugal separator and regulating the supply thereto, F. Ludloff 504,422
Chain, drive, W. H. Hart 504,494
Chair seat and back, B. H. Dodd 504,446
Chatelaine, J. C. Hayden 504,580
Chatelaine, umbrella, J. C. Hayden 504,579
Churn, W. W. Hinman 504,385
Clock, calendar, H. Grunberg 504,432
Clothes wringer, W. Thornton 504,483
Coal or ore bins, discharge apparatus for, R. W. Ericson 504,673
Coal or ore docks, discharge apparatus for, R. W. Ericson 504,674, 504,675
Coin-controlled apparatus, H. H. Buxbaum 504,555
Coin holder and counter, F. W. Smith 504,504
Coin tray, W. H. Staats 504,684
Coke and carbonizing oven, Bauer & Mendheim 504,548
Commutator for dynamo-electric machines, E. P. Warner 504,379
Confections, machine for moulding, C. H. Grebenstein 504,449
Cooler. See Liquid cooler. Water cooler.
Copy holder, W. O. Crane 504,414
Coupling. See Car coupling. Hoop coupling.
Crate or carrier, fruit or vegetable, J. E. Routh 504,623
Creamer, centrifugal, J. E. Folk 504,430
Crib, folding, Abbott & Robinson 504,646
Crosstie and railway construction, metallic, J. M. Price 504,540
Cultivator, W. H. Traphagen 504,406
Curtain ring and pin, combined, J. Lines 504,532
Cut-out, thermal, W. M. Goodridge 504,344
Cutter. See Band cutter. Brick or tile cutter. Finger or toe nail cutter.
Cutting-off and forming tool, G. E. Witherell 504,688
Cycle wheel, A. C. Brown 504,413
Damper regulator, J. H. Blake 504,659
Deflector, automatic wind, B. V. Crumrine 504,563
Dental engine, B. S. Brown 504,487
Dental engine, C. Doriot 504,490, 504,491
Dental plugger, C. Doriot 504,489
Dishcloth holder, C. Abell 504,647
Disintegrating clay, ores, etc., machine for, H. S. Albrecht 504,689
Doll, F. B. Schultz 504,627
Door check, D. H. Haywood 504,581
Door hanger, W. Kees 504,591
Door or shutter opener, J. Birkey 504,318
Door securer, J. N. Beall 504,653
Drier for cereals, etc., P. Borgarelli 504,320
Drilling machine, E. R. Lockwood 504,599
Drip trough, J. A. Knisley 504,420
Driving mechanism, reversing, H. C. Baker 504,651
Driving mechanism, safety, E. W. Ross 504,479
Dust pan, A. L. Hollander 504,474
Dynamos, method of and apparatus for regulating alternating current, H. Lemp 504,497
Eggs, preserving, C. E. McClure 504,535
Electric arc lighting system, T. Spencer 504,632
Electric conductor, J. W. Marsh 504,397, 504,398
Electric light pendant, incandescent, Johnston & Davidson 504,475
Electric lock, L. B. Tinkham 504,462
Electric motors by alternating currents, operating, A. Siemens 504,630
Electric switch, A. B. Herrick 504,528
Elevator bucket, T. Long 504,355
Elevator gate, W. H. Traphagen 504,407
Elevator safety device, Shurtz & Swan 504,629
Embossing and printing press, J. Y. Johnston 504,680
Embroidering machine, E. & R. Cornely 504,332
Emery wheels, construction of grinding, A. Johnston 504,388
Enamel, carriage or buggy top, Z. T. Fowler 504,339
End gate, wagon, G. C. Flagg 504,448
Engine. See Dental engine. Gas engine. Pumping engine. Rotary engine. Steam engine.
Envelope, mailing, J. T. Clark 504,560
Envelope opener, I. W. Heysinger 504,352
Extractor. See Lemon juice extractor.
Fabrics, apparatus for steaming, aging, and drying, Mather & Smith 504,602
Feed water regulator, W. Gladstone 504,574
Fence, J. E. Dusang 504,570
Fence, flood, F. B. Greer 504,346
Fence machine, I. M. Warner 504,642
Fence machine, slat and wire, N. F. Stanton 504,371
Fence post, W. M. Black 504,658
Fibers, machine for hackling and preparing, T. B. Allen 504,648
Fifth wheel, Wagner & Penquite 504,640
Filter, E. P. Hunt 504,434
Finger or toe nail cutter, E. T. Mason 504,601
Fire engines, cut-off for steam, C. E. Bensel 504,654
Fire escape, J. L. Gregory 504,576
Fire extinguisher nozzle, D. Curell 504,564
Fireproof construction, W. Orr 504,537
Flour bin and sifter, A. K. Gibson 504,342
Flying machine, E. B. Sowers 504,631
Fringes, machine for making and knotting, B. Arnold 504,315, 504,316
Fruit press, C. Wegmann 504,545
Furnaces, gas valve for blast, W. Rotthoff 504,622
Furrower and marker, combined land, J. Ramey 504,617
Fuse lighter, W. C. Matthews 504,603
Gauge. See Water gauge.
Garter, G. H. Blakesley 504,415
Gas engine, C. W. Pinkney 504,614
Gas heater F. P. Ziegler 504,382
Gas lighting or extinguishing apparatus, automatic, P. Everitt 504,447
Gas, tile for use in apparatus for the manufacture of, J. B. Archer 504,314
Gate. See Elevator gate. End gate.
Gate, J. Losey 504,392
Gate, C. H. Lucas 504,357
Gear casing, Forbes & Shepley 504,338
Gearing, J. Zimermann 504,645
Glass by sand blast, decorating, M. Suess 504,543
Glass, mosaic art, A. Verhaghen 504,506
Glassware, manufacture of, J. J. Brannagan 504,552
Governor, electric automatic steam, E. A. Edwards 504,492
Governing device for compound engines, M. C. Bullock 504,691
Governing gas, steam, or other motive power engines, apparatus for, C. W. Pinkney 504,613
Grain binder, J. F. Steward 504,373
Grain binder, automatic, J. F. Steward 504,372
Grain separator, J. C. Benson 504,466
Grain shocks, device for use in binding, P. Kiefer 504,592
Grapple, Manning & Wilson 504,600
Grate, fire, A. Stroh 504,635
Grinding and polishing tool, J. F. Budke 504,519
Grinding cutlery, apparatus for, A. Johnston 504,387
Grinding disk cutters and apparatus therefor, A. Johnston 504,386
Grinding machine, A. Johnston 504,389
Grinding machine, saw, J. B. Rhodes 504,104
Grinding rotary cutters, machine for, D. E. Bice 504,655
Grindstone, W. H. Clapp 504,329
Gun feed, machine, Broderick & Vankeirsbilck 504,516
Gun, machine, Broderick & Vankeirsbilck 504,517
Gun sight, T. E. Armitstead 504,696
Guns, telescopic sight for ships', B. A. Fiske 504,337
Hair cleaning machine, F. Hall 504,348
Hammock support, N. G. Reynolds 504,618
Harrow, folding, C. L. Burnett 504,428
Harrow tooth, L. D. Corser 504,444
Harvester, beet, H. B. Martin 504,423
Heater. See Gas heater. Oil heater. Water heater.
Heel stiffener machine, Chase & Foster 504,327
Hat, C. Harkins 504,350
Hinge, gate, C. M. Lamb 504,450, 504,451
Hinge polishing machine, E. A. Moore 504,498
Hinge, spring, L. R. Pomeroy 504,403
Hitch, halter, R. H. Bacot 504,650
Hoisting and conveying apparatus, D. Donahue 504,522
Hoof trimmer or parer, J. Matteson 504,400
Hook. See Snap hook. Whiffletree hook.
Hoop coupling, H. W. Ford 504,677
Horseshoe calk sharpener, S. R. Brooks 504,553
Hose, bridge, F. Kruckeberg 504,530
Hose carriage, W. T. Y. Schenck 504,624
Hot air register, W. M. Dyas 504,469
House. See Sanitary house.
Hydrant, W. H. Bootman 504,662
Hydrant J. Knickerbacker 504,594
Hydraulic motor, F. B. Cole 504,331
Hydrocarbon burner for stoves, furnaces, etc., W. S. Chilton 504,667
Hydropneumatic motor, W. Cooper 504,670
Ice cream freezer, J. K. Patterson 504,363
Indicator. See Temperature indicator.
Injector and exhauster, combined air, S. R. Earle 504,334
Jack. See Smoke jack.
Keyhole guard, G. Hisgen 504,583
Kitchen utensil, J. M. Tilman 504,376
Knitting machine, circular, E. Franck 504,417
Lace fastener, shoe, Drake & Higgins 504,568
Lamp burner, G. A. Burtner 504,554
Lamps, burner attachment for lighting, J. H. Flood 504,471
Lathe gearing, H. Binsse 504,657
Lathe taper attachment, D. Currie 504,565
Lemon juice extractor, J. Roberts 504,365
Liquid cooler, W. F. Kausen 504,590
Liquids from barrels, apparatus for drawing, H. E. Bailey 504,512
Loading or piling machine, G. S. Kaime 504,589
Lock. See Electric lock. Seal lock. Time lock.
Lock and latch, combined, F. F. Swanson 504,482
Locomotive, electric, A. I. Ambler 505 484
Locomotive, pneumatic hydraulic, W. Cooper, 504,668, 504,669
Locomotive sand box, T. F. O'Friel 504,609
Locomotive, tramway, C. D. Scott 504,541
Loom jacquard mechanism, G. Burkle 504,323
Loom shuttle binder, H. E. Hamilton 504,349
Loom shuttle tension device, E. Domenge 504,567
Loom warp beam, A. J. Seybert 504,442
Lubricator. See Windmill lubricator.
Mail marking machine, Bowman & Rice 504,664
Malting apparatus, G. J. Meyer 504,478
Mattress, W. Staab 504,443
Measuring can, liquid, L. W. Hemp 504,525
Measuring tank, self, L. W. Hemp 504,527
Medical compound, J. Schmid 504,626
Mixer and stirrer, A. Hancock 504,472
Motor. See Hydraulic motor. Hydropneumatic motor. Steam motor.
Mower clutch operating mechanism, lawn, T. Coldwell 504,330
Mower, lawn, C. H. Braithwaite 504,411
Mowing and harvesting machinery, cutting apparatus for, P. T. Walton 504,641
Mowing machine push bar, J. H. Jones 504,419
Musical instrument, C. Doriot 504,671
Musical instrument case, J. A. Weser 504,463
Net making machine, J. Knox 504,595
Nut lock, Cohen & Tharp 504,561
Nut lock, D. A. Leonard 504,5 96
Nut lock, I. Nappin 504, 608
Obstetrical appliance, J. H. & I. N. Leyda 504,598
Oil heater, A. G. Glasgow 504,524
Oil from crank pin journals of connecting rods, device for catching, R. M. La Touche 504,391
Ore separating machine, H. Bradford 504,665
Ore, separating or concentrating, H. Bradford 504,666
Painting, varnishing, etc., machine for, Dow & Crane 504,672
Pan. See Bake pan. Dust pan.
Paper, cardboard, etc., machine for cutting, G. W. Zeigler 504,509
Paper cutting machine, G. W. Zeigler 504,510
Phonograph, J. H. White 504,380
Photo-engravings, holder for plates in the manufacture of, M. Levy 504,597
Photographers' use, flash-light apparatus for, J. N. & H. J. Harrison 504,578
Pile fabrics, apparatus for cutting the pile of weft, G. Roger 504,441
Pill holding and dipping apparatus, A. D. Stearns 504,505
Pin. See Safety pin.
Pipes or tubes, machine for making, G. H. Winsor 504,687
Plane, joiner's, J. M. Cole 504,562
Planter, corn, D. J. Bowser 504,321
Plow heel sweep, H. D. Terrell 504,375
Plow, wheel, H. Lindestrom 504,531
Pole switch, double, Gartside & Wood 504,523
Polishing tools, feeding-up machine for, L. W. Kimble 504,593
Press. See Baling press. Embossing and printing press. Fruit press.
Pressure regulator, E. Webb 504,507
Pulley, C. A. Johnson 504,588
Pump, F. H. Romans 504,366
Pump, oil well, Gibson & Sutton 504,679
Pumping engine, direct-acting, C. C. Worthington 504,644
Puzzle, W. P. Groves 504,347
Railway, B. S. Henning 504,351
Railway, conduit electric, B. Bidwell 504,549
Railway conduit, electric, S. H. Flagg 504,676
Railway signal, electric, F. E. Seagrave 504,542
Railway switch, V. Angerer 504,649
Railway tie, metallic, E. Siskron 504,695
Register. See Autographic register. Cash register. Hot air register.
Registering machine, barrel, A. W. Oppmann 504,610
Regulator. See Damper regulator. Feedwater regulator. Pressure regulator.
Ring. See Curtain ring.
Roll truing machine, D. J. Davidson 504,566
Rolling mill feed table, W. H. Maddock 504,393
Rolling mill feeding mechanism, W. H. Maddock 504,395
Rolling mill transfer mechanism, W. H. Maddock 504,394
Rotary engine, J. F. McElroy 504,536
Rubber article, hollow, E. L. Perry 504,612
Rule, bevel, and square, combined, W. H. H. Garritt 504,341
Safety pin, C. E. Stevens 504,634
Sample, cloth or dress goods, J. M. Bostwick 504,550
Sanitary house, W. Van der Heyden 504,544
Sash operating mechanism, P. S. Riddelle 504,620
Saw set, E. W. Dillon 504,521
Saw set, gauge, and jointer, combined, E. M. Bickerstaff 504,656
Saw tooth, W. E. Brooke 504,412
Scale, letter, C. A. Miller 504,534
Screw blank feeding mechanism, H. K. Jones 504,435
Seal lock, O. E. Wheaton 504,643
Secondary battery, W. L Silvey 504,370
Seeder, F. S. McWhorter 504,500
Seeding machine, J. F. Parks 504,362
Separator. See Centrifugal separator. Grain separator.
Sewing machine quilting attachment, W. H. Chapman 504,558
Sewing machines, guide for double needle, L. Eschner 504,571
Shaft or bar iron, J. Green 504,431
Sheet metal forming machine, H. Senger 504,628
Shutter and slat operator, D. F. Goodall 504,575
Shutter, combined burglar and fireproof, E. H. Lunkes 504,533
Signal. See Railway signal.
Siphon, bottling, F. Barthold 504,513
Slicing mechanism for bread, etc., J. Fallows, 2d 504,429
Smoke jack, A. R. Anderson 504,511
Snap hook, A. A. Page 504,538, 504,539
Soldering iron, electrically heated, G. R. Meitzler (r) 11,364
Sole, A. A. Blandy 504,660
Spittoon carrier, G. B. Nagle 504,607
Sprocket wheel, V. Belanger 504,486
Stamp, hand, K. E. Wiberg 504,546
Stamping machine, D. F. Oliver 504,682
Stamping, inking and cleaning apparatus for die, A. G. Beater 504,465
Stanchion, cattle, W. Morgan 504,605
Staves, machine for dressing bucked, C. Sommer 504,461
Steam engine, G. Marshall 504,399
Steam motor, E. A. Edwards 504,493
Steel founding, J. G. McRoberts 504,361
Stool, cane, A. L. Chapman 504,326
Stool, piano, J. R. Peartree 504,633
Storage battery, C. J. Reed 504,455
Stove attachment, L. E. Love 504,356
Stovepipe and thimble fastener, Scott & Wisner 504,369
Stove protector, J. F. Bliven 504,319
Strainer for rain water pipes, C. H. Dodge 504,384
Strainer, pump spout, B. H. Messler 504,438
Surgical catheter, O. De Pezzer 504,424
Suspender end, W. Bloomberg 504,661
Switch. See Electric switch. Pole switch. Railway switch.
Switch movement, locking, J. T. Powers 504,502
Switchboard apparatus, multiple, W. M. Goodridge 504,345
Tank. See Measuring tank.
Tap, E. Hazlehurst 504,433
Telegraph system, condenser, C. H. Rudd 504,367
Telephone apparatus, Stromberg & Carlson 504,636
Telephone transmitter, N. Parks 504,454
Telephoning purposes, switchboard for, U. H. Balsley 504,464
Temperature indicator, Egan & Bailey 504,335
Thrashing machine, bean or grain, T. A. Miller 504,359
Tie. See Cross tie. Railway tie.
Tights, equestrienne, E. J. H. Pike 504,402
Time lock, I. G. Blake 504,427
Tire, pneumatic, Dobbins & McKenney 504,468
Trace or rein supporter. J. J. A. Van Patten 504,378
Transporting receptacle, Rogers & Hofman 504,503
Trimmer. See Hoof trimmer.
Trolley wire cleaner, M. Shaaber 504,405
Trough. See Drip trough.
Truck, M. S. Kelley 504,476
Trunk, J. J. Bisel 504,514
Tub. See Washtub.
Turfing implement, J. C. Greenfield 504,577
Type production, relief, J. W. Hoke (r) 11,363
Typewriting machine, L. D. Hitchcock 504,473
Vacuum apparatus, M. Swenson 504,374
Valve reseating machine, C. L. Morse 504,606
Vehicle brake, C. Goelz 504,343
Vehicle spindle, R. M. McBride 504,499
Vehicle wheel, J. E. Frist 504,340, 504,573
Vehicle wheel, H. Moore 504,440
Vehicle, wheeled, R. Steel 504,685
Velocipede, ice, J. Schmid 504,625
Vise and bench hook, E. G. Bailey 505,652
Vise, bench, T. B. Jackson 504,586
Wagon brake, J. Vanderveer 504,639
Wall, fireproof building, P. A. Deslauriers 504,415
Warping machine, A. E. Rhoades 504,459
Warping machines, mechanism for handling beams of, A. E. Rhoades 504,457
Washtub, E. Keith 504,495
Washing machine, J. A. Garrett 504,418
Water cooler, J. Hymans 504,585
Water cooler, A. W. Meyer 504,439
Water gauge, T. W. Miller 504,694
Water heater, F. Jakel 504,587
Welding apparatus, electric, H. Lemp 504,496
Well boring apparatus, Rickey & Fietel 504,619
Wheel. See Car wheel. Cycle wheel. Fifth wheel. Sprocket wheel. Vehicle wheel.
Whiffletree hook, W. J. Stowe 504,686
Wick, lamp, H. Pieper, Jr 504,501
Wind instrument, J. L. Maher 504,396
Wind instruments, self-acting water key for, J. Lindstrom 504,354
Windmill lubricator, O. H. Orton 504,611
Wire splicer, J. D. Thomas 504,638
Wire springs, machine for making, S. Konz 504,390
Wire stretcher, A. Ide 504,353
Wire stretcher, Schalk & Weinandy 504,368
Wrench handles, making, W. E. Brooke 504,518
Wringer. See Clothes wringer.

DESIGNS.

Coffin plate, G. H. Ford 22,769
Hat, lady's, J. D. Stange 22,766
Jigger, C. P. Dungan 22,768
Knee protector, A. C. Bull 22,767
Stove, cooking, C. W. Wipfler 22,770
Vehicle tee rail, W. A. Schleicher 22,771

TRADE MARKS.

Bicycles, tricycles, and velocipedes, Stover Bicycle Manufacturing Company 23,594
Bronzes and silver and plated ware, Tiffany & Company 23,572
Cement, hydraulic, Portland-Cement-Fabrik "Germania," H. Manske & Co 23,587
Chains, sash, Smith & Egge Manufacturing Company 23,590
Cigarettes, American Tobacco Company 23,580, 23,581
Drugs, L. Sollmann 23,583
Fruits, W. H. Westervelt & Co 23,575
Gum, chewing, Sultan & Wellington 23,574
Jewelry and watches, Tiffany & Company 23,573
Locks and keys, Smith & Egge Manufacturing Company 23,589
Medicines, certain named, J. R. Watkins 23,585
Oil, lubricating, F. L. Smith 23,588
Paper, writing, Kastner & Williams Paper Co 23,571
Plows, chilled, J. Oliver 23,595
Powders, healing, U. W. Becker 23,584
Pumps, chain, Olmsted & Co 23,591
Raisins, W. Forsyth 23,576
Remedy, catarrh, S. C. Wells & Co 23,586
Scales, weighing, E. & T. Fairbanks & Company, 23,592, 23,593
Teas, green and black, Reid, Murdoch & Company, 23,577 to 23,579
Tobacco, chewing, R. Everhart & Co 23,582

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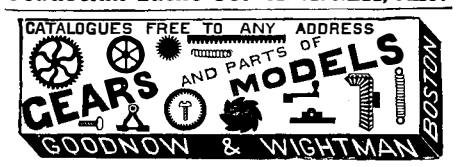

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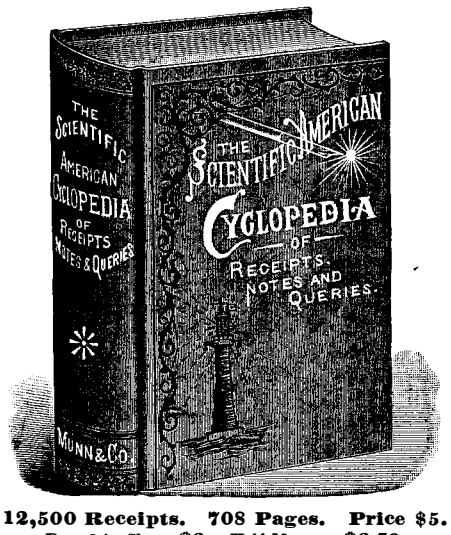

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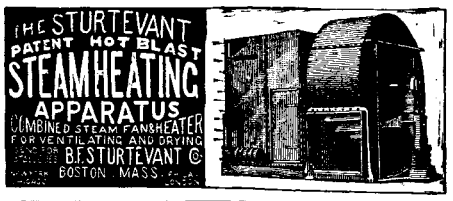

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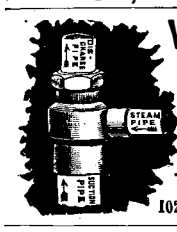

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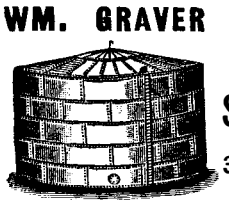

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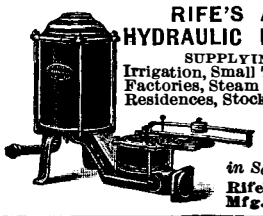

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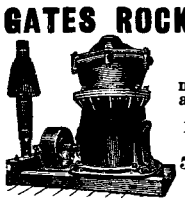

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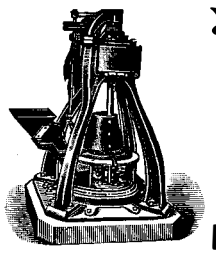

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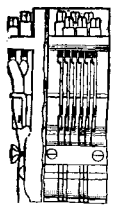

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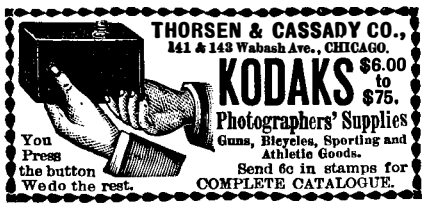

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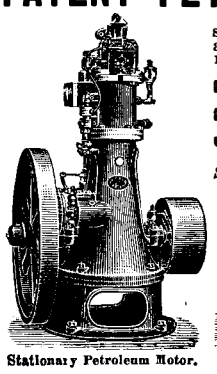
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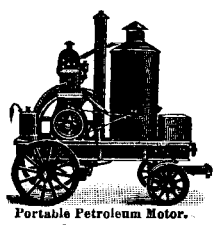
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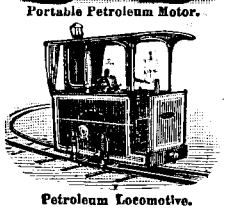
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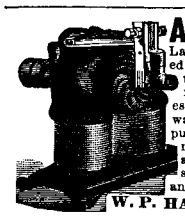

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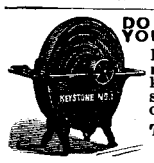

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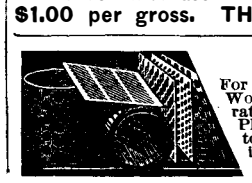

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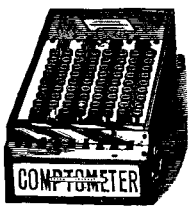

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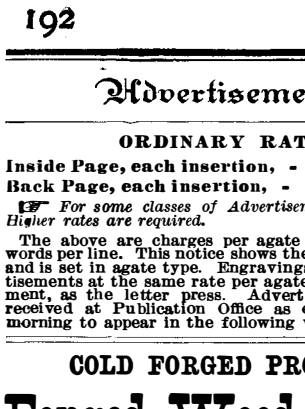

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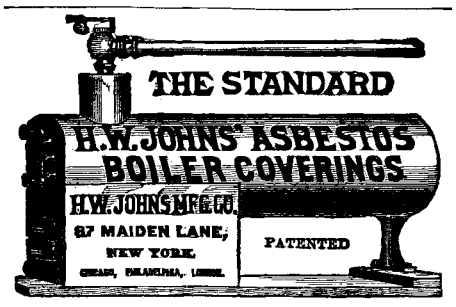

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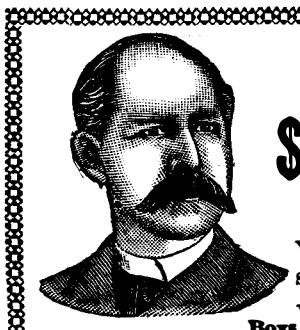

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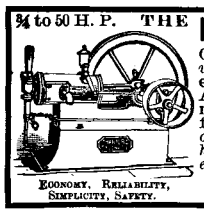

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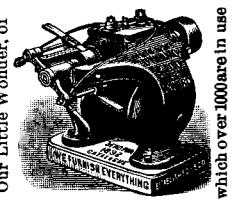

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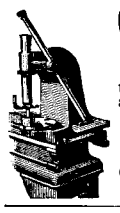

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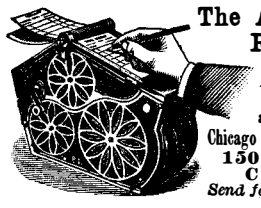

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